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UNITED STATES DEPARTMENT OF ENERGY STRATEGIC PETROLEUM RESERVE

PHASE II CERCLA REPORT: CONFIRMATION

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**Boeing
Petroleum
Services, Inc.**

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STRATEGIC PETROLEUM RESERVE

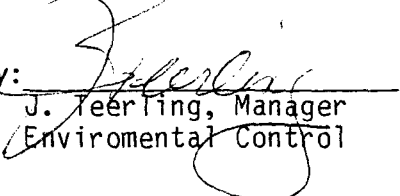
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EXECUTIVE SUMMARY

This report was prepared on behalf of the Department of Energy (DOE) by Boeing Petroleum Services, Inc. (BPS), the management, operations, and maintenance (MOM) contractor to DOE for the Strategic Petroleum Reserve (SPR). DOE Order 5480.14 requires all DOE-owned sites to achieve compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In accordance with the understanding reached between BPS and DOE, and as set forth in the letter dated March 28, 1985, DOE is the owner and operator of the SPR.

This report fulfills Phase III (Confirmation) of that order, which is to conduct sampling at the areas of potential hazardous waste identified in the Installation Assessment (Phase I) to confirm the presence or absence of hazardous waste. Recommendations to proceed to the Engineering Assessment (Phase III) are made for areas where the presence of hazardous waste is confirmed.

In Phase I, recommendations for further sampling were made for the Bayou Choctaw, Big Hill, Bryan Mound, and Sulphur Mines sites. This sampling was carried out as Phase II. Findings from that sampling follow.

1. Bayou Choctaw: Cavern 10 is believed to contain a caustic substance (corrosive hazardous waste). Allied Chemical stated that a potassium hydroxide solution was injected into the cavern. Sampling confirmed that the substance in the wellhead is caustic, probably a potassium hydroxide solution. An elevated lead level (EP toxic hazardous waste) was also identified.

A chromium-containing drilling mud additive was used for brine disposal well 1. The stabilized mud disposal area was sampled for EP (extraction procedure) toxicity, and found to be negative for this characteristic for all parameters, including chromium.

2. Big Hill: Unusually colored and viscous fluids had been found in some of the wells at Big Hill. The wells were sampled for priority pollutants. Elevated levels of metals were found in almost all wells, and small quantities of organics were also identified.

Chromium-containing drilling mud may have been used to drill some of the site wells. The cuttings disposal areas were sampled for EP toxicity and found to be negative for the fourteen EP toxicity constituents, including chromium.

3. Bryan Mound: A chromium-containing additive was added to the drilling muds used on the Phase III caverns. The stabilized mud pit was sampled and analyzed for EP toxicity and found to be negative for all EP constituents, including chromium.

Dow Chemical has stated that asbestos was disposed in caverns 4 and 5. These caverns were sampled and analyzed for asbestos. Asbestos concentrations in the brine were found to be below background levels observed in the Brazos River Diversion Channel.

A new tarry area was discovered near well pad 101. It was sampled and analyzed for priority pollutants, polynuclear aromatic hydrocarbons, and EP toxicity. Small quantities of inorganic priority pollutants were found, but the EP toxicity results showed the area to be nonhazardous.

Two tarry areas, an impoundment used by Dow Chemical, and the Freeport municipal landfill had been previously sampled and found to be nonhazardous. Therefore, they are not included in this report.

4. Sulphur Mines: A chromium-containing mud additive was used when drilling brine disposal wells 3 and 4. After well completion, the mud pits were left in place, capped, and seeded. They were sampled and analyzed for EP toxicity and found to be negative.

Several radioactive tracer pellets from the gravel pack on brine disposal well 4 are unaccounted for and may have remained in the mud pit. Radiation scans for evidence of the possible presence of these pellets in the associated mud pit and subsequent samples were conducted. No radiation levels above background were observed.

Recommendations to proceed to Engineering Assessment were made for Bayou Choctaw cavern 10 and for the Big Hill wells.

1. INTRODUCTION

1.1 BACKGROUND

A comprehensive assessment of the seven Strategic Petroleum Reserve (SPR) sites for evidence of the presence of hazardous wastes was carried out in 1985-86 in compliance with DOE Order 5480.14. The report resulting from that study, Phase I CERCLA Report: Installation Assessment (Document No. D506-01134-09) was published on August 8, 1986. That report described four SPR sites with one or more areas meriting further investigation for hazardous waste.

The areas by site are:

a. Bayou Choctaw

- 1) Mud pit: Drilling mud, from both old Allied Chemical (the previous site owner) mud pits and SPR activity, was disposed near brine disposal well pad 1. Some of the muds contained small quantities of a chrome ligno-sulfonate additive, which is potentially hazardous due to chromium content. The area had been lime stabilized.
- 2) Cavern 10: A caustic fluid was discovered during replacement of a wellhead pressure gauge. Discussion with Allied Chemical revealed that they had ~~disposed~~ approximately 300 barrels of a caustic potassium hydroxide solution into the cavern.

b. Big Hill

- 1) Cuttings disposal ponds: Three ponds were constructed for the disposal of cuttings and drilling mud. One of the drilling contractors is suspected of having added chrome lignosulfonate to the mud. The mud pits were not solidified at the time of sampling, although this has since been accomplished.

- 2) Freshwater cuttings disposal area: A pond was constructed for the disposal of freshwater cuttings. It was also used for the disposal of saline cuttings and drilling mud. The drilling mud was suspected to have contained chrome lignosulfonate. This area was backfilled and compacted.
- 3) Wells: Abnormally high viscosity and unusually colored fluids were discovered in some of the wells. Preliminary qualitative analysis showed a variety of organic constituents present. An SPR drilling contractor is suspected of having disposed various substances in the Big Hill wells. The wells drilled by this contractor were flushed with purchased brine by PB-KBB, the cavern engineering contractor.

c. Bryan Mound:

- 1) Mud pit: A mud pit was constructed for the disposal of drilling mud from the Phase III wells. Chrome lignosulfonate was used in the mud while drilling these wells. The mud pit was cement stabilized following completion of the wells.
- 2) Caverns 4 and 5: The previous site owner, Dow Chemical, disposed approximately 100 lbs. of asbestos into these two caverns.

d. Sulphur Mines:

- 1) Mud pits: Drilling mud from the construction of the brine disposal wells was deposited in pits adjacent to the wells, which were later covered and seeded. Chrome lignosulfonate was added to the muds used to drill brine disposal wells 3 and 4. In addition, several of the radioactive tracer pellets used in the

construction of brine disposal well 4 returned to the surface with the drilling mud, and it is not known if they were all recovered.

In addition to the areas identified in the Phase I CERCLA report, a tarry area was discovered at the Bryan Mound site in August, 1986, east of well pad 101. The origin of this area is unknown, although old site maps and photographs show storage tanks in the vicinity.

In addition to the areas incorporated in this report, in 1983 an EPA consultant identified four areas on the Bryan Mound site which were of potential concern: two tarry areas, the old Freeport municipal landfill, and an impoundment used by Dow. These areas were sampled in 1984 and found to be nonhazardous. Discussions concerning action on these areas have been held among EPA, DOE, and DOE's contractors.

1.2 SCOPE

This Phase II CERCLA Report: Confirmation covers the initial sampling and analytical work done in the areas of potential contamination described above. Recommendations for either no further action or to proceed to the Engineering Assessment are made based upon the analytical data.

2. SAMPLING AND ANALYTICAL MEASUREMENT PLAN

2.1 RATIONALE

The methodology for sampling and analysis was generally selected from EPA Publication SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, (SW-846). Other methodologies were used only when an applicable method could not be found in SW-846.

Random sampling is used when sampling a potentially contaminated area, to eliminate nonrandom biases and provide statistically representative data. To ensure complete coverage of the areas to be sampled, systematic random sampling was utilized for solid areas. This involves taking samples at regularly spaced intervals on one or more transects of an area.

The caverns at Big Hill were sampled using a variation of this method. Samples were generally taken at 1000-foot depth intervals and combined into a composite sample to represent the cavern. A continuous well flow density log was developed prior to sampling, and if an anomaly was detected on the log, the area of the anomaly was sampled in place of the nearest 1000-foot interval.

Due to the expense of collecting depth samples from a cavern leached to its final configuration, a single sample was collected from the wellheads of Bryan Mound caverns 4 and 5 and Bayou Choctaw cavern 10 for screening purposes. Asbestos in the Bryan Mound caverns, not trapped in the sump with other solid material, would remain in suspension in the brine, where it can be readily sampled. A representative sample of cavern brine can be easily and cost effectively obtained at the wellhead.

At Bayou Choctaw cavern 10 caustic (potassium hydroxide) was added at the top of the cavern, according to Allied Chemical. Subsequent work on that wellhead indicated that a caustic compound is present there. A sample was taken at the wellhead to verify the presence of caustic and identify any other associated compounds.

The number of sample points required for a statistically valid analysis depends on the existing data. With no existing data, the number of samples must be intuitively selected and calculations performed after results are received to determine whether the number of samples was sufficient. Five samples were taken from areas which had well-defined boundaries, and nine to ten samples were taken from areas where the boundaries were vague. The initial sampling of the newly discovered tar pit was handled at the site level, and only three samples were taken. In the case of wellhead samples, only one sample was taken, since multiple samples would not originate from substantially different areas.

2.2 METHODS AND TECHNIQUES

2.2.1 Sampling

Sampling of mud pits was done by means of augers in accordance with SW-846. Hand augers were used at Big Hill and Bayou Choctaw; power augers were used at Sulphur Mines and Bryan Mound. Some of the samples in the Big Hill cuttings disposal ponds were too soft to sample with an auger. These were sampled using a composite liquid waste sampler (COLIWASA). All samples were composites from the surface to the specified depth. A depth of six feet (selected after consultation with site personnel regarding expected pit depth) was used for all mud pits except those at Big Hill. The depth at Big Hill was the maximum practical depth for the equipment used (up to 8 feet for augered samples depending on soil hardness, and 9.5 feet for the

COLIWASA). Augering was performed following guidelines in ASTM Standard 1452-80.

The initial samples taken from the tarry area were collected by means of a small shovel. When the follow-up samples were collected, an attempt was made to use a coring device. This method was abandoned due to the hardness of the tar at the time of sampling, the shallow depth of most of the area, and the small quantity of sample obtained by the coring device. Instead, pieces of tar were fractured and pried loose for laboratory analysis.

Wellhead samples were taken by opening the small diameter brine piping valves located there. The depth samples at Big Hill were taken by a 5 quart wireline sampler, according to standard industry wireline sampling procedures.

2.2.2 Analysis

Chromium was the major constituent of concern in the mud pit samples. Hexavalent chromium is a constituent of the EP toxicity characteristic. Table 2-1 is a list of the EP constituents and their regulatory thresholds. The complete EP toxicity procedure is described in SW-846. The mud pits are not expected to display the hazardous characteristics of ignitability, corrosivity or reactivity due to the nature of the waste.

A wide variety of organic chemicals were found in the wells at Big Hill during preliminary qualitative analysis. Therefore, the samples were analyzed for the 129 priority pollutants and EP toxicity constituents. Priority pollutant analysis was by gas chromatography/mass spectroscopy for organics and by atomic absorption for metals, according to methodology in SW-846. The extraction techniques are also described in SW-846. Unlike EP toxicity, there are no set standards or levels for priority pollutants. The 129 priority pollutants are listed in Table 2.2.

The tar from Bryan Mound was analyzed for priority pollutants, EP toxicity, and polynuclear aromatic hydrocarbons (PAHs). Only a portion of PAHs are priority pollutants, but it was felt that a complete PAH analysis would aid in waste characterization. PAH analysis is by gas chromatography, and is described in SW-846.

The sample from Bayou Choctaw cavern 10 was analyzed for corrosivity by pH measurement, and EP toxicity according to procedures in SW-846. Sodium, chloride, and potassium (which are not hazardous constituents, but were measured to aid in waste characterization) were analyzed in accordance with Methods for Chemical Analysis of Water and Wastes, EPA Publication 600/4-79-020.

Analysis for asbestos in brine from Bryan Mound caverns 4 and 5 was performed by transmission electron microscopy, according to EPA Publication PB83-260 471.

Radiation was measured at Sulphur Mines brine disposal well pad 4 by means of an ion chamber type radiation meter.

2.3 QUALITY ASSURANCE

Laboratories were required to follow all quality assurance measures required by the EPA for the methods used. The approved quality assurance plan of Environmental Industrial Research Associates (EIRA), the laboratory which performed all of the analyses except for the tarry area at Bryan Mound, is contained in Appendix A. A complete quality assurance plan from Analytical Consulting Services (ACS) laboratories, which analyzed the tar samples, is not available, but the laboratory stated that they complied with all measures required for the methods used in SW-846.

TABLE 2-1

EP Toxicity Constituents and Regulatory Thresholds

| <u>CONSTITUENT</u> | <u>REGULATORY THRESHOLD* (MG/L OF EXTRACT)</u> |
|--------------------|--|
| Arsenic | 5 |
| Barium | 100 |
| Cadmium | 1 |
| Chromium | 5 |
| Lead | 5 |
| Mercury | 0.2 |
| Selenium | 1 |
| Silver | 5 |
| Endrin | 0.02 |
| Lindane | 0.4 |
| Methoxychlor | 10 |
| Toxaphene | 0.5 |
| 2,4-D | 10 |
| 2,4,5-TP | 1 |

* According to SW-846, a waste is considered hazardous if its 90% upper confidence limit exceeds this value for a particular constituent. See Appendix A for statistics.

Table 2-2

The 129 Priority Pollutants

COMPOUND NAME

Acenaphthene
Acrolein
Acrylonitrile
Benzene
Benzidine
Carbon tetrachloride
Chlorobenzene
1,2,4-Trichlorobenzene
Hexachlorobenzene
1,2-Dichloroethane
1,1,1-Trichloroethane
Hexachloroethane
1,1-Dichloroethane
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane
Chloroethane
bis(Chloromethyl) ether
bis(2-Chloroethyl) ether
2-Chloroethyl-vinyl ether
2-Chloronaphthalene
2,4,6-Trichlorophenol
Parachlorometacresol
Chloroform
2-Chlorophenol
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene

Table 2-2
The 129 Priority Pollutants
(continued)

3,3'-Dichlorobenzidine
1,1-Dichloroethylene
1,2-trans-Dichloroethylene
2,4-Dichlorophenol
1,2-Dichloropropane
1,3-Dichloropropylene
2,4-Dimethylphenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
1,2-Diphenylhydrazine
Ethylbenzene
Fluoranthene
4-Chlorophenyl-phenyl ether
4-Bromophenyl-phenyl ether
bis(2-chloroisopropyl) ether
bis(2-chloroethoxy) methane
Methylene chloride
Methyl chloride
Methyl bromide
Bromoform
Dichlorobromomethane
Trichlorofluoromethane
Dichlorodifluoromethane
Chlorodibromomethane
Hexachlorobutadiene
Hexachlorocyclopentadiene
Isophorone
Naphthalene
Nitrobenzene

Table 2-2
The 129 Priority Pollutants
(continued)

2-Nitrophenol
4-Nitrophenol
2,4-Dinitrophenol
4,6-Dinitro-o-cresol
N-Nitrosodimethyl amine
N-Nitrosodiphenyl amine
N-Nitrosodi-n-propyl amine
Pentachlorophenol
Phenol
bis(2-Ethylhexyl) phthalate
Butyl-benzyl phthalate
di-n-Butyl phthalate
di-n-Octyl phthalate
Diethyl phthalate
Dimethyl phthalate
Benzo(a)anthracene
Benzo(a)pyrene
3,4-Benzofluoranthene
Benzo(k)fluoranthene
Chrysene
Acenaphthylene
Anthracene
Benzo(ghi)perylene (1,12-benzoperylene)
Fluorene
Phenanthrene
Dibenzo(a,h)anthracene (1,2,5,6-dibenzanthracene)
Indeno (1,2,3-cd)pyrene (2,3-o-phenylenepyrene)
Pyrene
Tetrachloroethylene

Table 2-2
The 129 Priority Pollutants
(continued)

Toluene
Trichloroethylene
Vinyl chloride
Aldrin
Dieldrin
Chlordane
4,4'-DDT
4,4'-DDE
4,4'-DDD
alpha-Endosulfan
beta-Endosulfan
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide
alpha-BHC
beta-BHC
gamma-BHC (Lindane)
delta-BHC
PCB-1242
PCB-1254
PCB-1221
PCB-1232
PCB-1248
PCB-1260
PCB-1016
Toxaphene
Antimony

Table 2-2
The 129 Priority Pollutants
(continued)

Arsenic
Asbestos (Fibrous)
Beryllium
Cadmium
Chromium
Copper
Cyanide
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Zinc
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

3. SUMMARY OF DATA AND FINDINGS

In this section, the findings from each of the areas are summarized and presented. Statistical analysis, in accordance with SW-846, was performed on the results from each area. The statistics used are found in Appendix B. Sample locations are shown in Appendix C, while the laboratory reports are presented in Appendix D.

3.1 BAYOU CHOCTAW

3.1.1 Mud Pit

The mud pit is located to the south of brine disposal well pad 1 (see Appendix C, Figure C-1). The mud pit was lime stabilized, but analytical data describing the mud pit were not available.

The flattened and slightly depressed pit area is apparent and distinct from the surrounding area, providing an approximation of pit boundaries. Ten samples were taken in three parallel transects, as shown in Appendix C, Figure C-2. Hand augers were used to collect the samples, which were taken to a depth of six feet.

The mud pit area does not display EP toxicity characteristics. Chromium, the constituent of greatest concern, was detected at a maximum level of 0.22 mg/l, with a mean of 0.078 mg/l and a 90% upper confidence limit of 0.104 mg/l. The regulatory threshold is 5 mg/l. None of the organic EP toxicity constituents were detected. None of the other EP metals approached the regulatory threshold.

The results are summarized in Table 3-1, and the lab report is presented in Appendix D.

3.1.2 Cavern 10

Cavern 10, an abandoned cavern previously owned by Allied Chemical, is located in the western part of the site (see Appendix C, Figure C-3). It was abandoned by Allied Chemical in

1973, when brine returns were inexplicably lost. It is possible that the cavern had leached into the caprock or adjacent sediments. An attempt to wireline the cavern in the late 1970s was aborted after an obstruction was discovered at approximately 10 to 20 feet below the surface.

A sample was taken from the wellhead and analyzed for pH, sodium, chloride, potassium, and EP toxicity. ~~The pH of the sample was 13.7, which places it in the category of corrosive hazardous waste (EPA Hazardous Waste #D002). The potassium content of 234,000 mg/l~~ agrees with Allied Chemical's statement that the source of the elevated pH is potassium hydroxide that they disposed there.

Lead was found in the brine at a level of 89.4 mg/l. The source of lead is not known, although pipe dopes containing lead may have been used in the past. This level exceeds the 5 mg/l regulatory threshold, causing the waste liquid to be EP toxic (EPA Hazardous Waste #D008) as well as corrosive.

The extent of the substances will be further developed as part of the engineering assessment. The results of the initial sampling are shown in Table 3-2 and the lab report is contained in Appendix D.

3.2 BIG HILL

3.2.1 Cuttings Disposal Ponds

The three drill cuttings disposal ponds are located in the western part of the Big Hill site (see Appendix C, Figure C-4). The ponds are lined with polyethylene. Having not been solidified at the time of sampling, the contents of the ponds were very soft. Some samples were taken with hand augers, but most required the use of a COLIWASA sampler. Five samples, in an X pattern (see Appendix C, Figure C-5), were taken in each pond.

The three cuttings disposal ponds do not exceed the standards for the EP toxicity characteristic. The maximum level of chromium, the constituent of most concern, was found at 0.11 mg/l in a sample from the southern pond. The highest concentrations found in the northern and middle ponds were 0.07 mg/l and 0.08 mg/l respectively. The regulatory threshold for chromium is 5 mg/l.

The EP toxicity constituent found in the highest concentration was lead. The highest level found was 3.50 mg/l in a sample from the middle pond. The average value in this pond was 1.62 mg/l, and the 90% upper confidence limit was 2.39 mg/l. The regulatory threshold is 5 mg/l. The other two ponds had maximum levels of 1.24 and 1.43 mg/l, with correspondingly lower means and 90% confidence limits.

None of the organic EP toxicity constituents were detected. None of the other EP toxicity metals approached the regulatory threshold. Tables 3-3, 3-4, and 3-5 summarize the results of the sampling, and the lab report, containing the raw data, is presented in Appendix D.

3.2.2 Freshwater Cuttings Disposal Area

The freshwater cuttings disposal area is located in the western part of the Big Hill site, to the west of the BPS laydown yard (see Appendix C, Figure C-4). The general location is identifiable by a depression in the area. Nine sample points were selected in two perpendicular transects, as shown in Figure C-5. Hand operated augers were used to collect all samples. Sampling depth varied from four to seven feet depending on hardness and compaction of the soil. Sample depths are indicated in the laboratory report (see Appendix D).

Samples from the freshwater cuttings disposal area did not exceed the standards for any EP toxicity constituent. The constituent of greatest concern, chromium, was less than 0.005

mg/l. The constituent detected in the highest quantity was barium, at a maximum concentration of 1.8 mg/l, a mean level of 0.4 mg/l, and a 90% upper confidence limit of 0.58 mg/l. The regulatory threshold for barium is 100 mg/l. The presence of barium is not unexpected, since barite (barium sulfate) is frequently used as a drilling mud additive. Barium sulfate is not considered toxic, due to its low solubility in water. The remainder of the EP metals were detected, but at levels well below the regulatory threshold. None of the organic EP toxicity constituents were detected. The complete laboratory report is found in Appendix D, and a summary of the data in Table 3-6.

3.2.3 Wells

There are twenty-eight wells at the Big Hill SPR site, two for each planned cavern (see Appendix C, Figure C-4). Eighteen of the wells (nos. 101A-105B and 111A-114B) were drilled by Drillers Incorporated, while the remainder were drilled by Big Chief. Drillers Incorporated was suspected of having added substances other than clean brine into their wells. The cavern engineering contractor, PB-KBB, sampled some of the wells, and found high viscosity fluids of unusual colors at various points. Qualitative analysis showed a wide variety of mostly long chain hydrocarbon organic constituents present. The Drillers Incorporated wells were flushed with brine purchased from Tenneco Oil Company by PB-KBB.

Five samples were collected from each well and combined into a composite, as described in Section 2.1 of this report. All wells were sampled, including the wells drilled by Big Chief.

Low levels of organic priority pollutants were detected in most of the wells. The compounds were benzene, toluene, ethylbenzene, di-n-butyl phthalate, bis (2-ethylhexyl) phthalate, phenol, methylene chloride, 1,2-dichloroethane, vinyl chloride, isophorone, and n-nitrosodiphenyl amine. Only benzene, toluene,

ethyl benzene, and 1,2-dichloroethane were detected in quantities above 0.1 mg/l. None of the levels exceeded the EPA criteria for saltwater.

Unexpected quantities of inorganics were found in the wells. Lead concentrations exceeding 1 mg/l were found in 26 wells, cadmium levels in excess of 1 mg/l were found in three wells, and one well had an elevated mercury level of 4.8 mg/l. Copper levels of up to 111 mg/l, zinc levels of up to 467 mg/l, and cyanide levels of up to 480 mg/l were found. Antimony, nickel, and thallium were found in every well, with most levels exceeding 1 mg/l. Barium, with levels up to 40 mg/l, was found in several of the wells. It should be noted that these are priority pollutant levels, which represent total concentrations rather than leachate concentrations described by EP toxicity. No set criteria are given by the EPA for priority pollutants. Lead, cadmium, and mercury were found in levels exceeding their EP regulatory thresholds in some of the wells, but due to the difference in extractions, no conclusions can be made as to EP toxicity. EP toxicity will be evaluated as part of the Engineering Assessment.

Tables 3-7 through 3-34 contain the analytical results of the analyses of the Big Hill wells with one well shown per table. Only those organics which were detected at levels above the detection limit are listed in the tables. All inorganics are listed.

The complete laboratory report is not included in this document, due to its length. Inorganic analytical results for all wells and the organic results for Well 101A have been included in Appendix D, to give an example of the data. Archive copies of the complete report are maintained at the New Orleans SPR office and the site.

3.3 BRYAN MOUND

3.3.1 Mud Pit

The Bryan Mound mud pit is located near Mud Lake and southeast of cavern 114 (see Appendix C, Figure C-6). This pit was used for the disposal of drilling mud from the Phase III wells. The pit was cement stabilized, with no associated testing for metals.

Since the mud pit is well defined with clear boundaries, five samples were taken in an X pattern. Sample depth was to six feet in all cases, using a power auger.

The mud pit did not display EP toxicity characteristics. The highest level of chromium found was 0.100 mg/l, with an average level of 0.066 mg/l and a 90% upper confidence limit of 0.080 mg/l. The regulatory threshold is 5 mg/l.

The constituent found in the highest quantity was lead, with a maximum level of 2.12 mg/l and an average of 0.62 mg/l. The regulatory threshold for lead is 5 mg/l. None of the organic EP toxicity constituents were detected. Results are shown in Table 3-35, and the laboratory report may be found in Appendix D.

3.3.2 Caverns 4 and 5

Caverns 4 and 5 were constructed by Dow Chemical, the previous site owner, prior to DOE acquisition. Both are currently used by DOE for oil storage.

A Dow employee verbally stated that Dow had disposed approximately 100 pounds of asbestos in the caverns. This employee further stated that Dow had sampled the caverns in the past and found no asbestos, but written documentation substantiating these statements was not made available.

A brine sample was collected from the wellhead of Cavern 5 to determine the level of asbestos present. Cavern 4 was undergoing workover at that time, therefore a brine sample was collected from that cavern at a later date. A sample of water from the Brazos River Diversion Channel (the raw water source) was collected to provide a background asbestos level.

The asbestos levels, in duplicate analyses, of the cavern 5 sample were 26.7 and 33.8 fibers/ml. These are below the levels of 55.6 and 71.3 fibers/ml found in the background samples taken from the Brazos River Diversion Channel. Asbestos was not detected in the sample from Cavern 4. The detection limit was 8 fibers/ml. The complete laboratory report is found in Appendix D.

3.3.3 Tarry Area

A tarry area, of unknown origin, was discovered in August, 1986, near well pad 101 (see Appendix C, Figure C-6). The area nearby was being used as a soil disposal area, and it is thought that drought conditions and increased overburden pressure from the soils forced the tar to the surface.

Three initial samples were collected and analyzed for priority pollutants and the eight EP metals. One sample was found to have an elevated mercury level of 0.27 mg/l (regulatory threshold is 0.2 mg/l). This level was five times higher than the level found in the second sample, and eleven times the level found in the third sample. Statistical analysis showed that three samples were not adequate to accurately determine whether the tar was EP toxic or not. None of the other EP toxicity metals were found at levels approaching the regulatory threshold. The EP metals toxicity results are shown in Table 3-36A. EP toxicity pesticides and herbicides were not measured. Endrin, lindane and toxaphene were measured as priority pollutants, and were not detected by priority pollutant analysis.

Five priority pollutants were detected, in low quantities. Total phenols were also measured, and two additional organic compounds were detected. Results are shown in Table 3-36B. The laboratory report is in Appendix D.

On the basis of these results, a more extensive sampling plan was prepared. Ten samples were taken from the tar and analyzed for EP toxicity, priority pollutants, and polynuclear aromatic hydrocarbons. Sample locations are shown in Figure C-8.

The results of the second sampling of the tarry area show the area to be nonhazardous, since none of the EP toxicity constituents were present in levels approaching the regulatory threshold. Although elevated levels of chromium, lead, and mercury were found in the total extractions of the tar, the EP toxicity results show that the EP metals are bound to the matrix, and thus are nonhazardous. The highest EP level of mercury was 0.038 mg/l. When the data from both sets of samples were combined, the 90% upper confidence limit was found to be 0.062 mg/l. This is below the regulatory threshold of 0.2 mg/l. Statistical analysis showed the data to be sufficient to determine that the tar was nonhazardous for EP toxicity. Lead was found at a maximum EP level of 0.04 mg/l, while chromium was found at a maximum level of 0.016 mg/l in the EP extract. The regulatory thresholds of lead and chromium are 5 mg/l.

Aldrin was the only organic constituent detected in the analysis for priority pollutants. A single sample contained a level of 0.02 mg/kg. The highest levels of total cyanides and phenols detected were 0.052 and 0.23 mg/kg respectively. The non-EP priority pollutant metals copper, nickel, and zinc were detected at maximum levels of 15, 12, and 70 mg/kg respectively. Although the presence of aldrin, nickel, and cyanides may be used by the EPA to list a waste as hazardous, the presence of these substances does not automatically mean that a waste is hazardous. Regulatory thresholds are not given for priority

pollutants. The low levels of priority pollutants detected are not unusual for tar and do not appear to indicate contamination of the tar with hazardous substances. Since tar is not listed as a hazardous waste, and since the EP toxicity criteria are not exceeded, the area may be considered nonhazardous. Table 3-37 shows the EP toxicity data, and the laboratory report may be found in Appendix D.

3.4 SULPHUR MINES

Mud used to drill brine disposal wells 3 and 4 was deposited in trenches near the wells, covered, and seeded. The exact boundaries of the pits are unknown, but may be estimated by depressions in the surface. The locations of the brine disposal wells are shown in Appendix C, Figure C-9.

*possible
downy deposit
water
background*

Ten sampling points in two parallel transects at each area were selected. The transects are "L" shaped, in accordance with the remnant boundaries of the pit. Sample locations are shown in Figures C-10 and C-11 for brine disposal well pads 3 and 4, respectively. A power auger was used to sample the mud pits. Sample depth in all cases was six feet.

Data from analysis of the two mud pits did not exceed the limits for any constituent of EP toxicity. Chromium was not detected in either of the mud pits. The constituent found in the highest levels was barium, with maximum levels of 0.88 mg/l in the well pad 4 samples and 0.77 mg/l in the well pad 3 samples. The regulatory threshold for barium is 100 mg/l. None of the organic EP toxicity constituents were detected. Tables 3-38 and 3-39 summarize the respective results for the mud pits at brine disposal well pads 3 and 4. The laboratory report is in Appendix D.

Radiation was measured at brine disposal well pad 4, due to the possible presence of radioactive tracer pellets in the drilling mud. The area was scanned with a Victoreen Model 470A ion

chamber radiation meter, set to its most sensitive scale (0-3 mrem/hr). No radiation levels above background were observed. Each sample was scanned as it was being brought to the surface, and again after the sampling had been completed. No radiation above background was detected for any of the samples.

Table 3-1. Bayou Choctaw Mud Pit EP Toxicity Results
(all results in mg/l of extract)
(ten samples)

| <u>Constituent</u> | <u>RT</u> | <u>\bar{X}</u> | <u>Xmax</u> | <u>S</u> | <u>CI</u> | <u>DL</u> |
|--------------------|-----------|-----------------------------|-------------|----------|-----------|-----------|
| Arsenic | 5 | 0.0032 | 0.0050 | 0.0013 | 0.0038 | 0.0020 |
| Barium | 100 | 0.60 | 0.80 | 0.24 | 0.71 | 0.10 |
| Cadmium | 1 | 0.0074 | 0.0110 | 0.0025 | 0.0085 | 0.0050 |
| Chromium | 5 | 0.078 | 0.220 | 0.061 | 0.104 | 0.050 |
| Lead | 5 | 0.12 | 0.22 | 0.05 | 0.14 | 0.05 |
| Mercury | 0.2 | 0.0011 | 0.0018 | 0.0005 | 0.0013 | 0.0002 |
| Selenium | 1 | N/A | ND | N/A | N/A | 0.002 |
| Silver | 5 | 0.012 | 0.020 | 0.004 | 0.014 | 0.010 |
| Endrin | 0.02 | N/A | ND | N/A | N/A | 0.005 |
| Lindane | 0.4 | N/A | ND | N/A | N/A | 0.01 |
| Methoxychlor | 10 | N/A | ND | N/A | N/A | 0.05 |
| Toxaphene | 0.5 | N/A | ND | N/A | N/A | 0.1 |
| 2,4-D | 10 | N/A | ND | N/A | N/A | 0.065 |
| 2,4,5-TP | 1 | N/A | ND | N/A | N/A | 0.02 |

Note: On all tables, the following abbreviations are used:

| | |
|--------------------------------|--------------------------------|
| RT: Regulatory Threshold | CI: 90% Upper Confidence Limit |
| \bar{X} : Mean Concentration | DL: Detection Limit |
| Xmax: Maximum Concentration | ND: Not detected |
| S: Standard deviation | N/A: Not applicable |

Significant digits may vary from element to element, depending upon detection limit and instrument sensitivity.

Table 3-2. Bayou Choctaw Cavern 10 Analytical Results
(all results in mg/l except where otherwise noted)

| <u>Constituent</u> | <u>RT</u> | <u>Concentration</u> |
|--------------------|-------------------------|----------------------|
| Arsenic | 5 | <0.004 |
| Barium | 100 | 0.6 |
| Cadmium | 1 | 0.285 |
| Chromium | 5 | 0.39 |
| Lead | 5 | 89.4 |
| Mercury | 0.2 | 0.0036 |
| Selenium | 1 | <0.004 |
| Silver | 5 | 0.42 |
| Endrin | 0.02 | <0.005 |
| Lindane | 0.4 | <0.01 |
| Methoxychlor | 10 | <0.05 |
| Toxaphene | 0.05 | <0.1 |
| 2,4-D | 10 | <0.065 |
| 2,4,5-TP | 1 | <0.02 |
| Sodium | N/A | 903 |
| Potassium | N/A | 234,000 |
| Chloride | N/A | 1050 |
| pH (S.U.*) | ≤ 2 or ≥ 12.5 | 13.7 |

* S.U.: Standard Units

Table 3-3. Big Hill Drill Cuttings Pond #1 (North) EP Toxicity Results
(all results in mg/l of extract)
(five samples)

| <u>Constituent</u> | <u>RT</u> | <u>\bar{X}</u> | <u>Xmax</u> | <u>S</u> | <u>CI</u> | <u>DL</u> |
|--------------------|-----------|-----------------------------|-------------|----------|-----------|-----------|
| Arsenic | 5 | 0.018 | 0.034 | 0.012 | 0.026 | 0.002 |
| Barium | 100 | N/A | ND | N/A | N/A | 0.1 |
| Cadmium | 1 | 0.021 | 0.036 | 0.015 | 0.032 | 0.005 |
| Chromium | 5 | 0.065 | 0.070 | 0.012 | 0.072 | 0.005 |
| Lead | 5 | 1.15 | 1.24 | 0.06 | 1.19 | 0.05 |
| Mercury | 0.2 | 0.0027 | 0.0030 | 0.0004 | 0.0030 | 0.0020 |
| Selenium | 1 | 0.021 | 0.031 | 0.009 | 0.027 | 0.002 |
| Silver | 5 | 0.065 | 0.090 | 0.020 | 0.079 | 0.010 |
| Endrin | 0.02 | N/A | ND | N/A | N/A | 0.001 |
| Lindane | 0.4 | N/A | ND | N/A | N/A | 0.001 |
| Methoxychlor | 10 | N/A | ND | N/A | N/A | 0.001 |
| Toxaphene | 0.5 | N/A | ND | N/A | N/A | 0.01 |
| 2,4-D | 10 | N/A | ND | N/A | N/A | 0.002 |
| 2,4,5-TP | 1 | N/A | ND | N/A | N/A | 0.002 |

Table 3-4. Big Hill Drill Cuttings Pond #2 (Middle) EP Toxicity Results
(all results in mg/l of extract)
(five samples)

| <u>Contaminant</u> | <u>RT</u> | <u>\bar{X}</u> | <u>Xmax</u> | <u>S</u> | <u>CI</u> | <u>DL</u> |
|--------------------|-----------|-----------------------------|-------------|----------|-----------|-----------|
| Arsenic | 5 | 0.042 | 0.062 | 0.021 | 0.056 | 0.002 |
| Barium | 100 | N/A | ND | N/A | N/A | 0.1 |
| Cadmium | 1 | 0.017 | 0.025 | 0.008 | 0.022 | 0.005 |
| Chromium | 5 | 0.066 | 0.080 | 0.015 | 0.076 | 0.005 |
| Lead | 5 | 1.62 | 3.50 | 1.12 | 2.39 | 0.05 |
| Mercury | 0.2 | 0.002 | 0.002 | 0.000 | 0.002 | 0.002 |
| Selenium | 1 | 0.011 | 0.016 | 0.003 | 0.013 | 0.002 |
| Silver | 5 | 0.043 | 0.052 | 0.007 | 0.048 | 0.010 |
| Endrin | 0.02 | N/A | ND | N/A | N/A | 0.001 |
| Lindane | 0.4 | N/A | ND | N/A | N/A | 0.001 |
| Methoxychlor | 10 | N/A | ND | N/A | N/A | 0.001 |
| Toxaphene | 0.5 | N/A | ND | N/A | N/A | 0.01 |
| 2,4-D | 10 | N/A | ND | N/A | N/A | 0.002 |
| 2,4,5-TP | 1 | N/A | ND | N/A | N/A | 0.002 |

Table 3-5. Big Hill - Drill Cuttings Pond #3 (South) EP Toxicity Results
(all results in mg/l of extract)
(five samples)

| <u>Constituent</u> | <u>RT</u> | <u>\bar{X}</u> | <u>Xmax</u> | <u>S</u> | <u>CI</u> | <u>DL</u> |
|--------------------|-----------|-----------------------------|-------------|----------|-----------|-----------|
| Arsenic | 5 | 0.040 | 0.063 | 0.014 | 0.049 | 0.002 |
| Barium | 100 | N/A | ND | N/A | N/A | 0.1 |
| Cadmium | 1 | 0.027 | 0.039 | 0.012 | 0.035 | 0.005 |
| Chromium | 5 | 0.069 | 0.110 | 0.033 | 0.092 | 0.005 |
| Lead | 5 | 0.82 | 1.43 | 0.37 | 1.08 | 0.05 |
| Mercury | 0.2 | N/A | ND | N/A | N/A | 0.002 |
| Selenium | 1 | 0.010 | 0.013 | 0.003 | 0.012 | 0.002 |
| Silver | 5 | 0.035 | 0.044 | 0.008 | 0.040 | 0.010 |
| Endrin | 0.02 | N/A | ND | N/A | N/A | 0.001 |
| Lindane | 0.4 | N/A | ND | N/A | N/A | 0.001 |
| Methoxychlor | 10 | N/A | ND | N/A | N/A | 0.001 |
| Toxaphene | 0.5 | N/A | ND | N/A | N/A | 0.01 |
| 2,4-D | 10 | N/A | ND | N/A | N/A | 0.002 |
| 2,4,5-TP | 1 | N/A | ND | N/A | N/A | 0.002 |

Table 3-6. Big Hill Freshwater Cuttings Disposal Area EP Toxicity Results
(all results in mg/l)
(nine samples)

| <u>Constituent</u> | <u>RT</u> | <u>\bar{X}</u> | <u>Xmax</u> | <u>S</u> | <u>CI</u> | <u>DL</u> |
|--------------------|-----------|-----------------------------|-------------|----------|-----------|-----------|
| Arsenic | 5 | 0.0021 | 0.0030 | 0.0003 | 0.0023 | 0.0020 |
| Barium | 100 | 0.40 | 1.80 | 0.58 | 0.67 | 0.01 |
| Cadmium | 1 | 0.007 | 0.021 | 0.005 | 0.009 | 0.005 |
| Chromium | 5 | N/A | ND | N/A | N/A | 0.005 |
| Lead | 5 | 0.078 | 0.24 | 0.062 | 0.107 | 0.050 |
| Mercury | 0.2 | 0.0021 | 0.0030 | 0.0003 | 0.0023 | 0.0020 |
| Selenium | 1 | 0.007 | 0.021 | 0.006 | 0.010 | 0.002 |
| Silver | 5 | 0.011 | 0.020 | 0.003 | 0.013 | 0.010 |
| Endrin | 0.02 | N/A | ND | N/A | N/A | 0.001 |
| Lindane | 0.4 | N/A | ND | N/A | N/A | 0.001 |
| Methoxychlor | 10 | N/A | ND | N/A | N/A | 0.001 |
| Toxaphene | 0.5 | N/A | ND | N/A | N/A | 0.01 |
| 2,4-D | 10 | N/A | ND | N/A | N/A | 0.002 |
| 2,4,5-TP | 1 | N/A | ND | N/A | N/A | 0.002 |

Table 3-7. Big Hill Well 101A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|-------------------------|----------------------|
| Antimony | 6.3 |
| Arsenic | 0.070 |
| Barium | 5.25 |
| Beryllium | 0.063 |
| Cadmium | 0.998 |
| Total Chromium | 1.70 |
| Hexavalent Chromium | 0.05 |
| Copper | 10.7 |
| Lead | 85.3 |
| Mercury | 0.0012 |
| Nickel | 4.06 |
| Selenium | 0.248 |
| Silver | 0.75 |
| Thallium | 6.8 |
| Zinc | 92.9 |
| Total Cyanide | 0.69 |
| Benzene | 0.028 |
| Toluene | 0.120 |
| Ethylbenzene | 0.044 |
| Methylene Chloride | 0.018 |
| N-Nitrosodiphenyl amine | 0.054 |

Table 3-8. Big Hill Well 101B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 5.4 |
| Arsenic | 0.020 |
| Barium | 30.0 |
| Beryllium | 0.063 |
| Cadmium | 1.00 |
| Total Chromium | 2.76 |
| Hexavalent Chromium | 0.07 |
| Copper | 14.0 |
| Lead | 51.9 |
| Mercury | 0.0060 |
| Nickel | 4.32 |
| Selenium | 0.388 |
| Silver | 0.68 |
| Thallium | 6.2 |
| Zinc | 101 |
| Total Cyanide | 5.81 |
| Benzene | 0.009 |
| Toluene | 0.087 |
| Ethylbenzene | 0.012 |

Table 3-9. Big Hill Well 102A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|-------------------------|----------------------|
| Antimony | 4.4 |
| Arsenic | <0.004 |
| Barium | 0.40 |
| Beryllium | 0.054 |
| Cadmium | 0.910 |
| Total Chromium | 0.24 |
| Hexavalent Chromium | 0.08 |
| Copper | 0.68 |
| Lead | 3.56 |
| Mercury | 0.0006 |
| Nickel | 3.56 |
| Selenium | 0.032 |
| Silver | 0.64 |
| Thallium | 5.6 |
| Zinc | 1.18 |
| Total Cyanide | 0.08 |
| Toluene | 0.008 |
| N-Nitrosodiphenyl amine | 0.010 |

Table 3-10. Big Hill Well 102B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 4.8 |
| Arsenic | <0.004 |
| Barium | 0.60 |
| Beryllium | 0.078 |
| Cadmium | 0.886 |
| Total Chromium | 0.22 |
| Hexavalent Chromium | 0.09 |
| Copper | 0.76 |
| Lead | 3.20 |
| Mercury | 0.0006 |
| Nickel | 3.40 |
| Selenium | 0.046 |
| Silver | 0.64 |
| Thallium | 5.6 |
| Zinc | 0.91 |
| Total Cyanide | 0.04 |
| Benzene | 0.021 |
| Toluene | 0.036 |

Table 3-11. Big Hill Well 103A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 6.5 |
| Arsenic | 0.078 |
| Barium | 21.5 |
| Beryllium | 0.100 |
| Cadmium | 1.17 |
| Total Chromium | 2.93 |
| Hexavalent Chromium | 0.06 |
| Copper | 48.4 |
| Lead | 265 |
| Mercury | 0.0064 |
| Nickel | 5.83 |
| Selenium | 0.282 |
| Silver | 0.85 |
| Thallium | 6.5 |
| Zinc | 467 |
| Total Cyanide | 45.5 |
| Toluene | 0.026 |
| Methylene Chloride | 0.010 |

Table 3-12. Big Hill Well 103B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 5.2 |
| Arsenic | <0.004 |
| Barium | 40.0 |
| Beryllium | 0.070 |
| Cadmium | 0.900 |
| Total Chromium | 1.32 |
| Hexavalent Chromium | 0.05 |
| Copper | 1.16 |
| Lead | 5.48 |
| Mercury | 0.0018 |
| Nickel | 3.54 |
| Selenium | 0.006 |
| Silver | 0.64 |
| Thallium | 5.2 |
| Zinc | 8.62 |
| Total Cyanide | 10.4 |
| Benzene | 0.022 |
| Toluene | 0.030 |
| Ethylbenzene | 0.029 |
| Methylene Chloride | 0.017 |

Table 3-13. Big Hill Well 104A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 2.6 |
| Arsenic | <0.002 |
| Barium | 32.4 |
| Beryllium | 0.100 |
| Cadmium | 0.940 |
| Total Chromium | 1.06 |
| Hexavalent Chromium | 0.04 |
| Copper | 2.54 |
| Lead | 20.0 |
| Mercury | 0.0016 |
| Nickel | 3.30 |
| Selenium | 0.136 |
| Silver | 0.40 |
| Thallium | 6.4 |
| Zinc | 24.3 |
| Total Cyanide | 4.00 |
| Toluene | 0.023 |

Table 3-14. Big Hill Well 104A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|----------------------|----------------------|
| Antimony | 2.2 |
| Arsenic | 0.056 |
| Barium | 0.60 |
| Beryllium | 0.780 |
| Cadmium | 0.860 |
| Total Chromium | 0.22 |
| Hexavalent Chromium | 0.07 |
| Copper | 0.30 |
| Lead | 4.40 |
| Mercury | 0.0008 |
| Nickel | 2.60 |
| Selenium | <0.002 |
| Silver | 0.36 |
| Thallium | 5.0 |
| Zinc | 0.93 |
| Total Cyanide | 0.02 |
| Benzene | 0.010 |
| Toluene | 0.017 |
| di-n-Butyl Phthalate | 0.030 |
| Phenol | 0.010 |

Table 3-15. Big Hill Well 105A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 6.0 |
| Arsenic | 0.005 |
| Barium | 0.50 |
| Beryllium | 0.050 |
| Cadmium | 0.534 |
| Total Chromium | 0.16 |
| Hexavalent Chromium | 0.07 |
| Copper | 0.34 |
| Lead | 2.90 |
| Mercury | 0.0032 |
| Nickel | 3.30 |
| Selenium | 0.090 |
| Silver | 0.20 |
| Thallium | 2.5 |
| Zinc | 0.910 |
| Total Cyanide | 0.22 |
| Methylene Chloride | 0.012 |

Table 3-16. Big Hill Well 105B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 5.0 |
| Arsenic | <0.002 |
| Barium | 0.50 |
| Beryllium | 0.450 |
| Cadmium | 0.401 |
| Total Chromium | 0.20 |
| Hexavalent Chromium | 0.06 |
| Copper | 0.35 |
| Lead | 2.90 |
| Mercury | 0.0036 |
| Nickel | 3.30 |
| Selenium | 0.046 |
| Silver | 0.18 |
| Thallium | 2.5 |
| Zinc | 3.15 |
| Total Cyanide | 0.26 |
| 1,2-Dichloroethane | 0.21 |

Table 3-17. Big Hill Well 106A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|-------------------------|----------------------|
| Antimony | 5.4 |
| Arsenic | <0.006 |
| Barium | 0.80 |
| Beryllium | 0.084 |
| Cadmium | 0.916 |
| Total Chromium | 0.22 |
| Hexavalent Chromium | 0.06 |
| Copper | 0.56 |
| Lead | 4.72 |
| Mercury | 0.0015 |
| Nickel | 3.38 |
| Selenium | 0.012 |
| Silver | 0.38 |
| Thallium | 4.8 |
| Zinc | 0.494 |
| Total Cyanide | 0.04 |
| Benzene | 0.011 |
| Toluene | 0.011 |
| Methylene Chloride | 0.006 |
| N-Nitrosodiphenyl amine | 0.015 |

Table 3-18. Big Hill Well 106B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|-------------------------|----------------------|
| Antimony | 4.9 |
| Arsenic | 0.006 |
| Barium | 3.80 |
| Beryllium | 0.079 |
| Cadmium | 0.875 |
| Total Chromium | 0.30 |
| Hexavalent Chromium | 0.08 |
| Copper | 2.32 |
| Lead | 12.7 |
| Mercury | 0.0024 |
| Nickel | 3.64 |
| Selenium | 0.054 |
| Silver | 0.35 |
| Thallium | 4.3 |
| Zinc | 8.87 |
| Total Cyanide | 0.23 |
| Toluene | 0.008 |
| N-Nitrosodiphenyl amine | 0.011 |

Table 3-19. Big Hill Well 107A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 3.5 |
| Arsenic | 0.58 |
| Barium | 5.3 |
| Beryllium | 0.052 |
| Cadmium | 0.345 |
| Total Chromium | 0.40 |
| Hexavalent Chromium | 0.07 |
| Copper | 0.68 |
| Lead | 5.60 |
| Mercury | 0.0026 |
| Nickel | 2.30 |
| Selenium | 0.046 |
| Silver | 0.26 |
| Thallium | 3.3 |
| Zinc | 2.38 |
| Total Cyanide | 0.23 |
| Phenol | 0.011 |
| Methylene Chloride | 0.012 |

Table 3-20. Big Hill Well 107B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|-------------------------|----------------------|
| Antimony | 6.2 |
| Arsenic | <0.006 |
| Barium | 2.8 |
| Beryllium | 0.088 |
| Cadmium | 0.908 |
| Total Chromium | 0.28 |
| Hexavalent Chromium | 0.09 |
| Copper | 0.62 |
| Lead | 5.36 |
| Mercury | 0.0024 |
| Nickel | 3.90 |
| Selenium | 0.033 |
| Silver | 0.36 |
| Thallium | 5.0 |
| Zinc | 1.54 |
| Total Cyanide | 0.04 |
| N-Nitrosodiphenyl amine | 0.015 |

Table 3-21. Big Hill Well 108A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 4.0 |
| Arsenic | 0.048 |
| Barium | 3.2 |
| Beryllium | 0.038 |
| Cadmium | 0.235 |
| Total Chromium | 0.10 |
| Hexavalent Chromium | 0.05 |
| Copper | 0.82 |
| Lead | 3.20 |
| Mercury | 0.0026 |
| Nickel | 1.6 |
| Selenium | 0.044 |
| Silver | 0.20 |
| Thallium | 2.4 |
| Zinc | 2.99 |
| Total Cyanide | 0.23 |
| Benzene | 0.320 |
| Toluene | 0.620 |
| Ethylbenzene | 0.088 |
| Phenol | 0.016 |
| Isophorone | 0.011 |

Table 3-22. Big Hill Well 108B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 1.3 |
| Arsenic | <0.002 |
| Barium | 1.5 |
| Beryllium | 0.010 |
| Cadmium | 0.086 |
| Total Chromium | 0.18 |
| Hexavalent Chromium | 0.08 |
| Copper | 0.16 |
| Lead | 0.40 |
| Mercury | 0.0028 |
| Nickel | 0.40 |
| Selenium | 0.098 |
| Silver | 0.07 |
| Thallium | 0.4 |
| Zinc | 0.654 |
| Total Cyanide | 0.03 |
| Benzene | 0.060 |
| Toluene | 0.019 |
| Phenol | 0.010 |

Table 3-23. Big Hill Well 109A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|-------------------------|----------------------|
| Antimony | 4.8 |
| Arsenic | 0.007 |
| Barium | 7.7 |
| Beryllium | 0.247 |
| Cadmium | 0.430 |
| Total Chromium | 2.90 |
| Hexavalent Chromium | 0.06 |
| Copper | 1.06 |
| Lead | 6.38 |
| Mercury | 0.0030 |
| Nickel | 2.59 |
| Selenium | 0.064 |
| Silver | 0.22 |
| Thallium | 2.7 |
| Zinc | 5.86 |
| Total Cyanide | 0.02 |
| N-Nitrosodiphenyl amine | 0.010 |

Table 3-24. Big Hill Well 109B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 1.8 |
| Arsenic | <0.002 |
| Barium | 1.7 |
| Beryllium | 0.016 |
| Cadmium | 0.116 |
| Total Chromium | 0.12 |
| Hexavalent Chromium | 0.07 |
| Copper | 0.35 |
| Lead | 0.90 |
| Mercury | 0.0032 |
| Nickel | 0.61 |
| Selenium | 0.046 |
| Silver | 0.09 |
| Thallium | 0.6 |
| Zinc | 1.38 |
| Total Cyanide | 0.04 |

Table 3-25. Big Hill Well 110A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 0.7 |
| Arsenic | 0.008 |
| Barium | 1.5 |
| Beryllium | 0.009 |
| Cadmium | 0.049 |
| Total Chromium | 0.45 |
| Hexavalent Chromium | 0.02 |
| Copper | 5.74 |
| Lead | 24.0 |
| Mercury | 0.0062 |
| Nickel | 1.04 |
| Selenium | 0.034 |
| Silver | 0.04 |
| Thallium | 0.3 |
| Zinc | 115 |
| Total Cyanide | 1.99 |
| Toluene | 0.017 |
| Phenol | 0.017 |

Table 3-26. Big Hill Well 110B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 3.5 |
| Arsenic | 0.003 |
| Barium | 1.0 |
| Beryllium | 0.039 |
| Cadmium | 0.411 |
| Total Chromium | 0.17 |
| Hexavalent Chromium | 0.09 |
| Copper | 0.33 |
| Lead | 2.50 |
| Mercury | 0.0024 |
| Nickel | 2.67 |
| Selenium | 0.045 |
| Silver | 0.21 |
| Thallium | 3.8 |
| Zinc | 3.13 |
| Total Cyanide | 0.02 |

Table 3-27. Big Hill Well 111A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 12.8 |
| Arsenic | 0.320 |
| Barium | 7.0 |
| Beryllium | 0.095 |
| Cadmium | 0.900 |
| Total Chromium | 3.58 |
| Hexavalent Chromium | 0.10 |
| Copper | 111 |
| Lead | 115 |
| Mercury | 4.8 |
| Nickel | 5.78 |
| Selenium | 0.400 |
| Silver | 0.40 |
| Thallium | 7.3 |
| Zinc | 169 |
| Total Cyanide | 0.34 |
| Toluene | 0.013 |
| Ethylbenzene | 0.021 |
| Phenol | 0.025 |
| Methylene Chloride | 0.005 |

Table 3-28. Big Hill Well 111B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 6.6 |
| Arsenic | <0.004 |
| Barium | 1.2 |
| Beryllium | 0.054 |
| Cadmium | 0.852 |
| Total Chromium | 0.12 |
| Hexavalent Chromium | 0.08 |
| Copper | 0.80 |
| Lead | 3.20 |
| Mercury | 0.0036 |
| Nickel | 4.74 |
| Selenium | 0.060 |
| Silver | 0.28 |
| Thallium | 5.6 |
| Zinc | 0.442 |
| Total Cyanide | 0.09 |

Table 3-29. Big Hill Well 112A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|------------------------------|----------------------|
| Antimony | 3.3 |
| Arsenic | 0.048 |
| Barium | 0.90 |
| Beryllium | 0.033 |
| Cadmium | 0.705 |
| Total Chromium | 0.21 |
| Hexavalent Chromium | 0.07 |
| Copper | 0.75 |
| Lead | 4.31 |
| Mercury | 0.0036 |
| Nickel | 2.97 |
| Selenium | 0.062 |
| Silver | 0.62 |
| Thallium | 5.1 |
| Zinc | 0.567 |
| Total Cyanide | 0.17 |
| bis (2-Ethylhexyl) Phthalate | 0.013 |
| 1,2-Dichloroethane | 0.018 |
| Vinyl Chloride | 0.009 |

Table 3-30. Big Hill Well 112B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|------------------------------|----------------------|
| Antimony | 4.6 |
| Arsenic | <0.004 |
| Barium | 1.2 |
| Beryllium | 0.098 |
| Cadmium | 1.25 |
| Total Chromium | 0.30 |
| Hexavalent Chromium | 0.05 |
| Copper | 1.06 |
| Lead | 4.38 |
| Mercury | 0.0052 |
| Nickel | 4.72 |
| Selenium | 0.036 |
| Silver | 0.92 |
| Thallium | 7.2 |
| Zinc | 1.42 |
| Total Cyanide | 0.02 |
| bis (2-Ethylhexyl) Phthalate | 0.015 |
| 1,2-Dichloroethane | 0.005 |

Table 3-31. Big Hill Well 113A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 6.6 |
| Arsenic | <0.006 |
| Barium | 0.30 |
| Beryllium | 0.076 |
| Cadmium | 0.831 |
| Total Chromium | 0.17 |
| Hexavalent Chromium | 0.06 |
| Copper | 0.47 |
| Lead | 3.83 |
| Mercury | 0.0030 |
| Nickel | 3.36 |
| Selenium | 0.023 |
| Silver | 0.37 |
| Thallium | 3.7 |
| Zinc | 1.22 |
| Total Cyanide | 0.30 |
| Benzene | 0.051 |
| Toluene | 0.034 |
| Phenol | 0.094 |
| Methylene Chloride | 0.006 |
| 1,2-Dichloroethane | 0.490 |

Table 3-32. Big Hill Well 113B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 6.0 |
| Arsenic | <0.006 |
| Barium | 3.0 |
| Beryllium | 0.086 |
| Cadmium | 0.930 |
| Total Chromium | 0.36 |
| Hexavalent Chromium | 0.08 |
| Copper | 1.32 |
| Lead | 30.0 |
| Mercury | 0.0024 |
| Nickel | 3.90 |
| Selenium | 0.234 |
| Silver | 0.38 |
| Thallium | 4.6 |
| Zinc | 36.1 |
| Total Cyanide | 10.4 |
| Methylene Chloride | 0.006 |
| 1,2-Dichloroethane | 1.800 |

Table 3-33. Big Hill Well 114A Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 5.0 |
| Arsenic | <0.004 |
| Barium | 1.2 |
| Beryllium | 0.068 |
| Cadmium | 0.592 |
| Total Chromium | 0.16 |
| Hexavalent Chromium | 0.07 |
| Copper | 0.87 |
| Lead | 2.60 |
| Mercury | 0.0210 |
| Nickel | 2.92 |
| Selenium | 0.056 |
| Silver | 0.28 |
| Thallium | 4.6 |
| Zinc | 0.492 |
| Total Cyanide | 480 |
| Benzene | 0.024 |
| Toluene | 0.035 |
| 1,2-Dichloroethane | 0.011 |

Table 3-34. Big Hill Well 114B Analytical Results
(all results in mg/l)

| <u>Constituent</u> | <u>Concentration</u> |
|---------------------|----------------------|
| Antimony | 6.4 |
| Arsenic | 0.196 |
| Barium | 10.6 |
| Beryllium | 0.056 |
| Cadmium | 0.808 |
| Total Chromium | 1.86 |
| Hexavalent Chromium | 0.06 |
| Copper | 23.0 |
| Lead | 210 |
| Mercury | 0.0112 |
| Nickel | 5.72 |
| Selenium | 0.400 |
| Silver | 0.38 |
| Thallium | 5.4 |
| Zinc | 189 |
| Total Cyanide | 0.16 |
| Benzene | 0.320 |
| Toluene | 0.990 |
| Ethylbenzene | 0.110 |
| Methylene Chloride | 0.006 |
| 1,2-Dichloroethane | 0.048 |

Table 3-35. Bryan Mound Mud Pit EP Toxicity Results
(all results in mg/l of extract)
(five samples)

| <u>Constituent</u> | <u>RT</u> | <u>\bar{X}</u> | <u>Xmax</u> | <u>S</u> | <u>CI</u> | <u>DL</u> |
|--------------------|-----------|-----------------------------|-------------|----------|-----------|-----------|
| Arsenic | 5 | 0.0078 | 0.022 | 0.0083 | 0.0135 | 0.0020 |
| Barium | 100 | 0.242 | 0.300 | 0.071 | 0.291 | 0.100 |
| Cadmium | 1 | 0.0186 | 0.0270 | 0.0056 | 0.0224 | 0.0050 |
| Chromium | 5 | 0.066 | 0.100 | 0.021 | 0.080 | 0.050 |
| Lead | 5 | 0.06 | 2.10 | 0.84 | 1.20 | 0.05 |
| Mercury | 0.2 | 0.0033 | 0.0055 | 0.0017 | 0.0045 | 0.0002 |
| Selenium | 1 | 0.002 | 0.002 | 0.000 | 0.002 | 0.002 |
| Silver | 5 | 0.034 | 0.050 | 0.011 | 0.042 | 0.010 |
| Endrin | 0.02 | N/A | ND | N/A | N/A | 0.01 |
| Lindane | 0.4 | N/A | ND | N/A | N/A | 0.005 |
| Methoxychlor | 10 | N/A | ND | N/A | N/A | 0.05 |
| Toxaphene | 0.5 | N/A | ND | N/A | N/A | 0.01 |
| 2,4-D | 10 | N/A | ND | N/A | N/A | 0.035 |
| 2,4,5-TP | 1 | N/A | ND | N/A | N/A | 0.035 |

Table 3-36A. Bryan Mound Tarry Area Initial EP Toxicity Results
(all results in mg/l of extract)
(three samples)

| <u>Constituent</u> | <u>RT</u> | <u>\bar{X}</u> | <u>Xmax</u> | <u>S</u> | <u>CI</u> | <u>DL*</u> |
|--------------------|-----------|-----------------------------|-------------|----------|-----------|------------|
| Arsenic | 5 | N/A | ND | N/A | N/A | 0.002 |
| Barium | 100 | 0.86 | 0.98 | 0.13 | 1.01 | |
| Cadmium | 1 | N/A | ND | N/A | N/A | 0.01 |
| Chromium | 5 | 0.046 | 0.056 | 0.009 | 0.056 | |
| Lead | 5 | 0.037 | 0.052 | 0.015 | 0.053 | |
| Mercury | 0.2 | 0.12 | 0.27 | 0.13 | 0.26 | |
| Selenium | 1 | N/A | ND | N/A | N/A | 0.05 |
| Silver | 5 | 0.033 | 0.05 | 0.015 | 0.050 | |

* Detection limit not available for constituents which were detected.

Note: Only EP metals were analyzed.

Table 3-36B. Bryan Mound Tarry Area Initial Priority
Pollutant Analysis Results
(all results in mg/l)
(three samples)

| <u>Constituent</u> | <u>Concentration</u> | | |
|-------------------------|----------------------|-----------------|-----------------|
| | <u>Sample 1</u> | <u>Sample 2</u> | <u>Sample 3</u> |
| Phenanthrene | 0.0060 | 0.0064 | 0.0075 |
| Dibutyl Phthalate | 0.0562 | 0.0068 | <0.0025 |
| Chlorobenzene | 0.0064 | 0.0075 | <0.0060 |
| Chloroethane | <0.0050 | 0.0087 | <0.0050 |
| Total Cyanides | 0.15 | 0.22 | 0.17 |
| Total Phenols * | 10.4 | 12.3 | 8.9 |
| Methylhydroxybenzoate * | 0.0093 | Not analyzed | Not analyzed |
| Methyl Naphthalene* | 0.0025 | 0.0025 | 0.0021 |

* Not a priority pollutant

Note: Priority pollutants which were not detected in at least one of the three samples are not listed.

Table 3-37. Bryan Mound Tarry Area Analytical Results
(all results in mg/l of extract)
(ten samples)

| <u>Constituent</u> | <u>RT</u> | <u>\bar{X}</u> | <u>Xmax</u> | <u>S</u> | <u>CI</u> | <u>DL</u> |
|--------------------|-----------|-----------------------------|-------------|----------|-----------|-----------|
| Arsenic | 5 | 0.012 | 0.027 | 0.005 | 0.014 | 0.010 |
| Barium | 100 | 0.029 | 0.150 | 0.044 | 0.048 | 0.010 |
| Cadmium | 1 | 0.001 | 0.003 | 0.001 | 0.015 | 0.001 |
| Chromium | 5 | 0.011 | 0.016 | 0.002 | 0.011 | 0.010 |
| Lead | 5 | 0.013 | 0.040 | 0.009 | 0.017 | 0.010 |
| Mercury | 0.2 | 0.011 | 0.038 | 0.014 | 0.017 | 0.002 |
| Selenium | 1 | N/A | ND | N/A | N/A | 0.02 |
| Silver | 5 | N/A | ND | N/A | N/A | 0.02 |
| Endrin | 0.02 | N/A | ND | N/A | N/A | 0.02 |
| Lindane | 0.4 | N/A | ND | N/A | N/A | 0.02 |
| Methoxychlor | 10 | N/A | ND | N/A | N/A | 0.01 |
| Toxaphene | 0.5 | N/A | ND | N/A | N/A | 0.02 |
| 2,4-D | 10 | N/A | ND | N/A | N/A | 0.01 |
| 2,4,5-TP | 1 | N/A | ND | N/A | N/A | 0.1 |
| Mercury* | 0.2 | 0.035 | 0.270 | 0.073 | 0.062 | 0.002 |

*These figures combine the data from both sets of samples, for a total of 13 samples.

Table 3-38. Sulphur Mines Brine Disposal Well Pad 3 Mud Pit EP Toxicity Results
(all results in mg/l of extract)
(ten samples)

| <u>Constituent</u> | <u>RT</u> | <u>\bar{X}</u> | <u>Xmax</u> | <u>S</u> | <u>CI</u> | <u>DL</u> |
|--------------------|-----------|-----------------------------|-------------|----------|-----------|-----------|
| Arsenic | 5 | 0.0025 | 0.0050 | 0.0011 | 0.0030 | 0.0020 |
| Barium | 100 | 0.48 | 0.77 | 0.17 | 0.55 | 0.10 |
| Cadmium | 1 | 0.0053 | 0.0080 | 0.0008 | 0.0056 | 0.0050 |
| Chromium | 5 | N/A | ND | N/A | N/A | 0.05 |
| Lead | 5 | 0.053 | 0.060 | 0.004 | 0.054 | 0.050 |
| Mercury | 0.2 | 0.0041 | 0.0320 | 0.0098 | 0.0083 | 0.0002 |
| Selenium | 1 | N/A | ND | N/A | N/A | 0.002 |
| Silver | 5 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 |
| Endrin | 0.02 | N/A | ND | N/A | N/A | 0.00005 |
| Lindane | 0.4 | N/A | ND | N/A | N/A | 0.0005 |
| Methoxychlor | 10 | N/A | ND | N/A | N/A | 0.001 |
| Toxaphene | 0.5 | N/A | ND | N/A | N/A | 0.0001 |
| 2,4-D | 10 | N/A | ND | N/A | N/A | 0.065 |
| 2,4,5-TP | 1 | N/A | ND | N/A | N/A | 0.02 |

Table 3-39. Sulphur Mines Brine Disposal Well Pad 4 Mud Pit EP Toxicity Results
(all results in mg/l of extract)
(ten samples)

| <u>Constituent</u> | <u>RT</u> | <u>\bar{X}</u> | <u>Xmax</u> | <u>S</u> | <u>CI</u> | <u>DL</u> |
|--------------------|-----------|-----------------------------|-------------|----------|-----------|-----------|
| Arsenic | 5 | 0.0022 | 0.0040 | 0.0006 | 0.0020 | 0.0020 |
| Barium | 100 | 0.55 | 0.88 | 0.21 | 0.64 | 0.10 |
| Cadmium | 1 | 0.010 | 0.019 | 0.005 | 0.012 | 0.005 |
| Chromium | 5 | N/A | ND | N/A | N/A | 0.05 |
| Lead | 5 | 0.680 | 0.130 | 0.032 | 0.082 | 0.050 |
| Mercury | 0.2 | 0.0053 | 0.0370 | 0.0110 | 0.0100 | 0.0002 |
| Selenium | 1 | N/A | ND | N/A | N/A | 0.002 |
| Silver | 5 | 0.011 | 0.020 | 0.003 | 0.120 | 0.010 |
| Endrin | 0.02 | N/A | ND | N/A | N/A | 0.00005 |
| Lindane | 0.4 | N/A | ND | N/A | N/A | 0.0005 |
| Methoxychlor | 10 | N/A | ND | N/A | N/A | 0.001 |
| Toxaphene | 0.5 | N/A | ND | N/A | N/A | 0.0001 |
| 2,4-D | 10 | N/A | ND | N/A | N/A | 0.065 |
| 2,4,5-TP | 1 | N/A | ND | N/A | N/A | 0.02 |

4. INTERPRETATION AND ANALYSIS

4.1 BAYOU CHOCTAW

4.1.1 Mud Pit

The mud pit by Bayou Choctaw brine disposal well pad 1 was found to be nonhazardous for EP toxicity constituents. No evidence of other potential contamination was identified during the Phase I assessment. The area, which had been lime stabilized on closure, has re-vegetated, with no signs of environmental problems. Hazard Ranking System (HRS) worksheets have not been prepared, since, based on the analytical results, the scores would be zero.

4.1.2 Cavern 10

The fluid in the wellhead of Bayou Choctaw cavern 10 is hazardous due to ~~lead content and corrosivity. The extent and quantity of the substances will be determined during the Engineering Assessment.~~ The presence of an obstruction in the casing offers the possibility that the quantity may be relatively small and confined. The density of the fluid in the wellhead was found to be 1.268, while the density of saturated brine is approximately 1.20. This would seem to indicate that a total blockage exists, since the heavier wellhead fluid would sink into the cavern if there were communication between the wellhead and cavern fluids. If the obstruction is not total, the substances could be more widespread, extending into the cavern proper.

~~The potential for migration from the cavern is not known.~~ A cavern in a salt dome is confining under normal circumstances, but the lost brine returns that occurred in this cavern may indicate that the cavern has been leached into the permeable caprock. However, lost brine returns may have been due to a leak within the piping string, in which case the cavern may still be confining. ~~Determination of cavern integrity will be conducted during the Engineering Assessment.~~

Further investigation of Bayou Choctaw cavern 10, to be conducted as part of the Engineering Assessment, is currently in the planning stage. The HRS worksheets are in Appendix E.

4.2 BIG HILL

4.2.1 Cuttings Disposal Ponds

The cuttings disposal ponds at Big Hill were found to be nonhazardous for all EP toxicity constituents. There is no evidence of contamination by other compounds. The cuttings disposal ponds have recently been solidified. HRS worksheets have not been prepared, since, based on the analytical results, the scores would be zero.

4.2.2 Freshwater Cuttings Disposal Area

The freshwater cuttings disposal area was found to be nonhazardous for EP toxicity constituents. No evidence exists of contamination by other compounds. The vegetation in the area appears to be damaged from the presence of salt water cuttings, but is recovering. No other environmental problems are evident. HRS worksheets have not been prepared, as the scores would be zero.

4.2.3 Wells

Inorganic priority pollutants are present at unexpectedly high levels in almost every sample. Small amounts of organic constituents were found in some of the wells, but the levels of organics are overshadowed by the inorganics. (All organic constituents for which EPA saltwater criteria exist were found in levels below those criteria.)

The origin of the inorganic constituents is not known. The level of organics found in the wells varies, and is rarely high. However, high levels of certain inorganics were consistently found. Wells drilled by both drilling contractors are affected. Potential sources are the drilling fluids, brines used to flush the wells, transporters, and the salt dome itself.

The brine is contained in the wells, with little potential for migration. The wells have been pressure tested as required for oil storage cavern wells, and found to be satisfactory. The presence of these constituents in the brine may affect the planned leaching schedule, since the brine would be displaced at, if not prior to, the start of leaching operations.

A Phase III Engineering Assessment will be carried out as required by Order 5480.14. Further analysis to trace the origin of the constituents will be included, as well as investigation of potential methods of mitigation and disposal. HRS worksheets may be found in Appendix E.

4.3 BRYAN MOUND

4.3.1 Mud Pit

The mud pit at Bryan Mound is nonhazardous for EP toxicity, with all EP constituents below hazardous criteria. There is no evidence of significant contamination by other compounds. The pit had been cement stabilized during closure. Since the area is nonhazardous, HRS worksheets have not been prepared, as the scores would be zero.

4.3.2 Caverns 4 and 5

The asbestos levels found in the brine from Bryan Mound caverns 4 and 5 do not indicate that the brine is a health hazard. Asbestos was not detected in cavern 4, and the level detected in cavern 5 was below the level found in the raw water source at the time of sampling. HRS worksheets were not prepared, since the scores would be zero.

4.3.3 Tarry Area

The tarry area near cavern 101 at Bryan Mound is nonhazardous for EP toxicity constituents. Low levels of inorganic priority pollutants were found. These are not unexpected in tar and do

not render the substance hazardous. Since the tar is a waste, it will be removed in accordance with applicable regulations for nonhazardous material. HRS worksheets have not been prepared. The scores would be zero due to the nonhazardous nature of the waste.

4.4 SULPHUR MINES

The mud pits by Sulphur Mines brine disposal wells 3 and 4 are nonhazardous for EP toxicity constituents. Increased levels of radiation were not detected at the well 4 mud pit. There is no evidence of other constituents in the mud pits. Vegetation in the area of the mud pits is thriving, and no environmental problems are visible. HRS worksheets were not prepared for the sites, since the sites are not hazardous and the scores would be zero.

5. RECOMMENDATIONS

5.1 BAYOU CHOCTAW

5.1.1 Mud Pit

Based on the previous analysis and data interpretation, a recommendation of no further action is made for the mud pit by Bayou Choctaw brine disposal well pad 1.

5.1.2 Cavern 10

The high levels of lead and the corrosivity of the brine from Bayou Choctaw cavern 10 wellhead warrant continued analysis and investigation. ~~A thorough study of cavern 10 to determine the extent of the corrosive brine and lead, the intactness of the cavern, and possible methods to dispose of the waste should be undertaken.~~ The Engineering Assessment, which is currently in the planning stage, will address these matters.

Initial plans call for demolition of a derrick that stands over the well, followed by a workover procedure to remove or break through an obstruction in the casing. The cavern will be surveyed to determine size and configuration, and to identify any areas where its fluid might leak into the caprock. A pressure test will also be conducted to aid in assessing the containment offered by the cavern. Depth samples will be collected at intervals and analyzed for pH, EP toxicity, priority pollutants, sodium, potassium, and chloride. These data will then be used to develop a method for removal and disposal or treatment of the waste.

5.2 BIG HILL

5.2.1 Cutting Disposal Ponds

Based on the previous analysis and data interpretation, a recommendation of no further action is made for the Big Hill cuttings disposal ponds.

5.2.2 Freshwater Cuttings Disposal Area

Based on the previous analysis and data interpretation, a recommendation of no further action is made for the Big Hill freshwater cuttings disposal area.

5.2.3 Wells

The elevated levels of metals found in the Big Hill wells warrants further investigation. The Engineering Assessment will characterize the extent of the substances in each well and will identify potential sources and possible alternatives for disposal. Leaching of the caverns may need to be delayed until sufficient information to plan for brine disposal is available.

Planned actions include expedited analysis of: existing salt cores; individual depth samples taken during the Phase II sampling; and, brine from the sources used to fill the wells. The analysis of the salt cores will determine the metals content of the salt, providing evaluation of the dome as a potential source for the identified constituents. The analysis of the individual depth samples will determine the distribution of the constituents within the given wells. The composite samples from Phase II will be analyzed for EP extracted metals, to determine whether the metals found were bound or free.

5.3 BRYAN MOUND

5.3.1 Mud Pit

Based on the previous analysis and data interpretation, a recommendation of no further action is made for the Bryan Mound mud pit.

5.3.2 Caverns 4 and 5

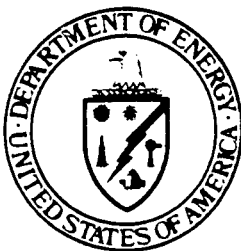
Based on the previous analysis and data interpretation, a recommendation of no further action is made for Bryan Mound caverns 4 and 5.

5.3.3 Tarry Area

Based on the previous analysis and data interpretation, the tarry area near Bryan Mound well pad 101 was found to be nonhazardous, and does not fall within the scope of CERCLA. Since the tar is a waste, it is recommended that the area be cleaned up and properly disposed as nonhazardous waste.

5.4 SULPHUR MINES

Based on the previous analysis and data interpretation, a recommendation of no further action is made for the mud pits at Sulphur Mines brine disposal wells 3 and 4.



UNITED STATES DEPARTMENT OF ENERGY STRATEGIC PETROLEUM RESERVE

WEST HACKBERRY

PHASE II CERCLA REPORT: CONFIRMATION

APPENDIX TO
Publication D506-01438-09

*XREF SA VOL 1.
LA 289 003 2582*

**Boeing
Petroleum
Services, Inc.**

SUPERFUND
FILE

JUN 23 1992

REORGANIZED

APPENDIX A

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC.
QUALITY ASSURANCE PLAN

QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance

Environmental Industrial Research Associates, Inc. (EIRA) complies with applicable **Quality Assurance** procedures including "Guidelines and Specifications for Preparing QA Program Plans", QAMS-005/80; "Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities", EPA SW-611; "Test Methods for Evaluating Solid Waste", EPA SW-846, July 1982; and "Handbook for Sampling and Sample Preservation of Water and Wastewater", EPA 600/4-82-029, September 1982.

EIRA clearly recognizes the need for a sound **Quality Assurance** program and will implement all procedures necessary to insure the reliability of the data produced.

The **Quality Control** program that EIRA follows in performing analytical work may be summarized as follows:

Instrumentation

Instrument Maintenance

Instruments will be generally maintained following manufacturers' specific timetables. More frequent maintenance may, however, be dictated depending upon actual operating performance. Instrument logs will be maintained to document the date and type of maintenance performed. Service contracts on major instruments with manufacturers and service agencies will be used to provide routine preventive maintenance, ensure rapid response for emergency repair service, and reduce instrument down time. The date and time of all maintenance activities will be recorded in a maintenance log book.

Instrument Calibration

All instruments will be regularly calibrated. The manner in which the various instruments are calibrated will of course depend on the particular instrument and the intended use of the instrument. A record of all calibrations and daily checks will be kept in a calibration log book.

Personnel Training

All project analysts are trained (or certified) by experienced EIRA personnel and/or trained at instrument manufacturers' training courses as may be appropriate. Each analyst will be required to independently generate data on several method and/or matrix spikes to demonstrate proficiency in that analytical method. The type of data to be generated will be dependent on the particular analytical method involved and "certification" will then be determined by the appropriate Section Manager.

Since method blanks and method spikes are required for routine samples in every lot, performance on a day-to-day basis can be monitored by comparison with the original and cumulative data on similar samples. Supervisors and the laboratory Quality Control Manager will be responsible for ensuring that samples are analyzed by qualified analysts.

Standard Analytical Methods

Analytical methods will be conducted as outlined in published sources (EPA, Standard Methods, ASTM, AOAC, etc.) whenever possible. Complex or unusual matrices, or a request for analytes which do not have established methods, may require modification of existing methods or the development of a new one. The method used, as well as the results of Quality Control samples which determine the applicability of the method chosen, will be reported with submitted sample results.

Gas Chromatography/Mass Spectroscopy Calibration

Mass Spectrometers will be tuned according to manufacturers' specifications. In addition, once every twelve hours, these instruments will be tested with bromofluorobenzene (BFB) or decafluorotriphenylphosphine (DFTPP) to meet the criteria set forth in EPA Method 624 or 625, respectively.

Initial calibration curves for analytes (appropriate to the analyses to be performed) are generated for at least three standard solutions containing known concentrations of authentic standards of compounds of concern. The calibration curve will bracket the anticipated working range of analyses or the dynamic range of the Mass Spectrometer.

Calibration data, to include the correlation coefficient, will be achieved to maintain a permanent record of instrument calibrations.

Quality Control

During each operating shift following the documentation of a successful BFB or DFTPP tune, a midpoint calibration standard will be analyzed to verify that instrument responses are still within initial calibration determinations.

All GC/MS analyses will include analyses of a set of matrix spike duplicates in each lot of twenty samples of like matrix. In addition, appropriate surrogate compounds will be spiked into each sample prior to extraction or volatile stripping. Recoveries from matrix spikes and surrogate compounds are calculated and reported.

Audit samples will be analyzed periodically to compare and verify laboratory performance against standards prepared by outside sources. Standards used will either be made from pure materials or will be traceable to EPA stocks.

Gas Chromatography

Calibration

Gas Chromatographs will be calibrated prior to each day of use. Calibration standard mixtures will be prepared from appropriate reference materials and will contain analytes appropriate for the method of analysis.

Working standards will include a blank and a minimum of three concentrations to cover the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. Curves of concentration versus detector response will be plotted. A correlation coefficient of at least 0.996 will be required in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be obtained, additional standards must be analyzed to define the calibration curve. A mid-point calibration check standard will be analyzed each shift to confirm the validity of the initial calibration curve. The calibration check standard must be within 20% of the initial response curve to demonstrate that the initial calibration curve is still valid.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

Quality Control

At least one method blank and two matrix spike duplicates will be included in each laboratory lot of samples. Method spikes will be at a concentration of approximately five times the detection limit. The purpose of these Quality Control samples is to determine if contamination is being introduced in the laboratory, to show the applicability of the method chosen, and to document the laboratory's performance in applying the method.

The method spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery of the spikes; precision will be measured by the reproducibility of both method spikes.

Atomic Absorption Spectrophotometry

Initial Calibration

Three methods of analysis by Atomic Absorption (AA) Spectrophotometry are used for metals determination. Most metals are analyzed using direct flame aspiration. Arsenic and selenium, however, are analyzed using graphite furnace analysis and mercury is analyzed by the cold vapor technique. The instrument is calibrated for the above procedures according to the manufacturer's recommendations. Calibration standards are prepared for each element from stock metal solutions. Four levels of standard concentrations are prepared including one at the instrument detection limit. Standards containing less than 1.0 mg/l of the element of interest will be prepared before each analysis. All standards are stored in clean, high-density polyethylene bottles. All standards and samples are prepared and analyzed at a 1% Nitric Acid concentration level. The standards for calibration are

injected or aspirated (depending on method) using the blank first and working toward the highest concentration. Absorbance is recorded at each standard level.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

Calibration Verification Standards

After the instrument has been calibrated initially, the calibration is verified by an independent calibration verification solution. This solution is available from the EPA. When an EPA solution is unavailable, the analysis is conducted on an independent standard at a concentration other than used for calibration. Table 1 shows the control limits for initial calibration verification.

TABLE 1

| <u>Method</u> | <u>Species</u> | <u>Percent of True Value</u> | |
|------------------|----------------|------------------------------|-------------------|
| | | <u>Low Limit</u> | <u>High Limit</u> |
| AA Flame/Furnace | Metals | 90 | 110 |
| Cold Vapor | Mercury | 80 | 120 |

Instrument Detection Limit Determination

Instrument detection limits are determined quarterly for each element analyzed. The instrument detection limits (in mg/l) is determined by multiplying by three, the average of the standard deviations obtained on three nonconsecutive days from the analysis of a standard solution (each analyte in reagent water) at a concentration three to five times the instrument detection limit with seven consecutive measurements per day.

Calibration Blank

A calibration blank is analyzed each time the instrument is calibrated and at the beginning and end of each run. In addition, the calibration blank is analyzed at a frequency of once every ten samples during the run. If a value greater than the report detection limits is found, analysis will be terminated, the problem corrected, and the instrument recalibrated.

Continuing Calibration Verification

Calibration accuracy is verified during a run with an independent standard at a concentration approximately the midpoint of the analytical range. These standards are run at a frequency of once every ten samples. If the deviation in the continuing calibration standard is greater than that listed in Table 1, the instrument must be recalibrated.

Reagent Blank Analysis

At least one reagent blank consisting of distilled-deionized water is processed through each sample preparation procedure. The frequency of the reagent blank is one for each twenty samples analyzed. The value for the reagent blank must be less than one-tenth of the lowest sample concentration or lower than the report detection limit.

Spiked Sample Analysis

Spiked samples are used to provide information about the effect of the sample matrix on the digestion and measurement methodology. The spike is added to at least one sample per each twenty samples before the digestion. Spike levels are determined by the element of interest. Spike recovery should be within 75-125% of spike level.

Duplicate Sample Analysis

At least one sample per twenty samples will be analyzed in duplicate. Data which does not agree within $\pm 20\%$ (Relative Percent Difference) will result in re-analysis of the sample or samples.

Total Organic Carbon Calibration

Each Total Organic Carbon analyzer will be calibrated prior to each day of use. Calibration standards will be prepared from potassium hydrogen phthalate, and working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of five concentrations over the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus reported concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to analysis of samples. Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

Quality Control

At least one method blank and two method blank spikes will be included in each laboratory lot of samples. Method blank spikes will be at a concentration of approximately five times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory. The method blank spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery of the spikes. The recovery must be within the range of 90-110% to be considered acceptable.

Precision will be measured by the reproducibility of both method spikes. Results must agree within 20% in order to be considered acceptable.

Spectrophotometric Methods

Calibration

Spectrophotometers will be calibrated prior to each day of use. Calibration standards will be prepared from reference materials appropriate to the analysis being performed, and working calibration standards will be prepared fresh daily. The working standards will include a blank and a minimum of five concentrations over the anticipated range of measurement. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus reported concentrations will be at least 0.996 in order to consider the responses linear over a range. If a correlation coefficient of 0.996 cannot be achieved, the instrument will be recalibrated prior to the analysis of samples.

Calibration data, to include the correlation coefficient, will be entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

Quality Control

At least one method and two method blank spikes will be included in each laboratory lot of samples. Regardless of the matrix being processed, the method blank spikes and the blanks will be in aqueous media. Method blank spikes will be at a concentration of approximately five times the detection limit.

The method blanks will be examined to determine if contamination is being introduced in the laboratory.

The method spikes will be examined to determine both precision and accuracy. Accuracy will be measured by the percent recovery of the spikes. The recovery must be in an acceptable range (based on EPA data for the method of interest) in order to be considered acceptable.

Precision will be measured by the reproducibility of both method spikes. Results must agree with acceptable limits (based on EPA data) in order to be considered acceptable.

Methods Development

When standard (published) methods of analyses are not applicable to analyses to be performed, methods can be developed to provide the desired information. However, the lack of a historical data base will not obviate the necessity for documented Quality Control data to demonstrate the validity of the generated results. Reference material sources would then be identified, and proof of compound identity and purity would have to be available. Instrument operating parameters as well as calibration data would be documented, and specific procedures (to include sampling, if applicable) noted.

Quality Control samples (method blanks, method spikes, method spike duplicates, matrix spikes, and matrix duplicates) would be analyzed with greater frequency than with standard analytical methods.

Reference Materials

Whenever possible, primary reference materials will be obtained from the National Bureau of Standards (NBS) or the Environmental Protection Agency (EPA). In the absence of available reference materials from these organizations, other reliable sources will be sought. These reference materials will be used for instrument calibration, quality control samples, and/or performance evaluations. Secondary reference material may be used for these functions provided that they are traceable to an NBS standard or have been compared to an NBS standard within the laboratory.

Reagents

Laboratory reagents will be of a quality to minimize or eliminate background concentrations of the analyte to be measured. Reagents must also not contain other contaminants that will interfere with the analyte of concern.

Corrective Actions

When an analytical system is deemed to be questionable or out of control at any level of review suitable, corrective actions will be performed. If possible, the cause of the problem will be determined and efforts made to correct the problem. Such equipment will not be used absent subsequent satisfactory calibration and/or Quality Control sample data.

Data Management Data Collection

Data describing the processing of samples will be recorded in laboratory notebooks which will, at a minimum, contain date of analyses, sample numbers, client (optional), analyses or operation performed, calibration data, Quality Control samples included, concentrations/dilutions required, instrument readings, special observations (optional), and analyst's signature.

Data Reduction

Data reduction performed by individual technicians or analysts will result in a determination of concentrations of parameters in samples based on the raw data obtained from instrument measurements. The complexity of the data reduction will of course depend on the specific analytical method and the number and kind of operations (extractions, dilutions, and concentrations) involved in obtaining each sample.

For those methods utilizing a calibration curve, sample responses will be applied to a linear regression curve, the result of which will be factored into equations in order to estimate concentrations in the original sample. Rounding will not be performed until after the final result is obtained to minimize rounding errors, and results will not normally be expressed in more than two significant figures. All raw data and the calculations used to generate final results will be retained on file to allow reconstruction of the data reduction process, if necessary, at a later date.

Data Review

System reviews will be routinely performed at all levels. Individual analysts will routinely review the quality of data through calibration checks, Quality Control sample results, and performance evaluation analysis. Reviews will be made prior to submission for consistency and reasonableness with other data. Selected hard copy output of data (chromatograms, spectra, etc.) will be reviewed to ensure that results are interpreted correctly. Unusual or unexpected results will be reviewed and resolved through re-analysis if necessary. In addition, the Section Manager will recalculate selected results to verify the calculation procedure.

The Quality Assurance Manager will independently conduct a complete review of selected analysis to assure that all Quality Assurance/Quality Control requirements have been met. Discrepancies will be reported to the appropriate Section Manager for resolution.

Data Reporting

Reports will contain final results (uncorrected for blanks and recoveries), methods of analysis, levels of detection, surrogate recovery data, method blank data, and any other laboratory Quality Control data requested by the Division. In addition, special analytical problems and/or any modifications of referenced methods will be noted.

The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two significant figures.

Data will normally be reported in units commonly used for the analyses performed. Concentrations in liquids are expressed in terms of weight per unit volume (e.g., milligrams per liter). Concentrations in solid or semi-solid matrices are expressed in terms of weight per unit weight of sample (e.g., micrograms per gram).

Reported detection limits will be the concentration in the original matrix corresponding to the low level instrument calibration standard after concentration, dilution, and/or extraction factors are accounted for.

Data Archiving

EIRA will maintain on file all of the raw data, laboratory notebooks, and other documentation relating to a given project. The file will be maintained for five years following the analysis unless a written request is received for an extended retention time.

Data retrieval from archives will be handled in a similar fashion to a request for analysis. Specifically, a written work request to include a quotation must be submitted for retrieval of data.

Standard Reference Materials

Standard Reference Materials (SRM) are independently supplied samples with known concentrations of selected parameters. They are often accompanied not only with a known value but an acceptable range for analytical results. EIRA maintains a full supply of available SRM. A SRM is determined with each set of samples regardless of the number of samples/sets. In cases where independently supplied SRM are not available, one will be prepared by the laboratory staff.

Blanks

An analyst must always be aware of the potential problems associated with contamination of glassware, reagents, solvent, etc., which are especially critical during trace level analyses. The method used to monitor possible contamination problems is the analysis of blanks. There are generally three types of blanks that are routinely analyzed. The first is the method blank which consists of analyzing deionized water in exactly the same fashion as a sample. This type of blank points out problems such as contaminated glassware and reagents. A method blank is performed with each set of analysis in the laboratory regardless of the number of samples in the set. The second type of blank is a reagent/solvent blank which is utilized to check the purity of the new batches or lots of reagents or solvents. This type of blank is performed as necessary. The third blank is a field blank which provides information on possible contamination of samples in the field during collection and transport.

Laboratory Water, Solvents, and Gases

Laboratory water used for making reagents and rinsing of glassware will constantly be monitored by an in-line meter which will meet or exceed electrical conductivity requirements of TYPE I water as described in the EPA Quality Control Handbook, March 1979. All laboratory solvents utilized for sample extractions will be at pesticide grade. Solvents will be checked for purity on a continuing basis for compounds which may interfere with the specific analysis being performed. Gases used for chromatographic procedures will be of high purity or ultra-high purity and will be equipped with scrubbers to remove trace constituents. Scrubbers used will include oxygen traps, molecular sieves, and/or moisture traps. Each will be useful for specific applications in Gas Chromatography, and different combinations may be employed depending on particular instrument requirements.

Laboratory Glassware

Whenever possible, disposable glassware will be employed to reduce the possibility of cross-contamination of samples. Glassware used for metals analyses will be cleaned using nitric acid according to EPA approved protocol (EPA Quality Control Handbook, March 1979).

Glassware to be used for inorganic analysis will be cleaned following approved EPA protocol as follows: rinsed with last solvent used immediately after use, rinsed with reagent grade acetone, soap washed, tap water rinsed, nitric acid rinsed, deionized water rinsed, rinsed with reagent grade methanol, rinsed with reagent grade acetone, and rinsed with pesticide grade hexane.

APPENDIX B

STATISTICS

Statistics

The analysis of sampling results is based upon standard statistical formulas. The mean, variance, standard deviation, and standard error are calculated and used to obtain the confidence interval and number of samples required to judge whether the waste is hazardous or nonhazardous. These statistics may be found in SW-846.

The formulas are as follows:

$$\text{Mean: } \bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

where: \bar{x} = arithmetic mean of all values
 x_i = each individual value
 n = number of samples

$$\text{Variance: } s^2 = \frac{\sum_{i=1}^n x_i^2 - \left[\left(\sum_{i=1}^n x_i \right)^2 / n \right]}{n-1}$$

where: s^2 = variance

$$\text{Standard Deviation: } s = \sqrt{s^2}$$

where: s = standard deviation

$$\text{Standard Error: } s_{\bar{x}} = \frac{s}{\sqrt{n}}$$

where: $s_{\bar{x}}$ = standard error

$$\text{Confidence Interval: } CI = \bar{x} + ts_{\bar{x}}$$

where: CI = confidence interval
 t = t value from Student's t -test table

In the case of EP toxicity, a waste is considered hazardous if the 90% upper confidence limit is greater than the regulatory threshold. In this case, the t value used is $t_{.20}$, and only the upper (plus) confidence limit is used.

Number of samples required:

$$n = \frac{t^2 s^2}{\Delta^2}$$

where: n = number of samples required for a statistically valid analysis

$$\Delta = RT - \bar{x}$$

RT = regulatory threshold

APPENDIX C
SAMPLE LOCATIONS

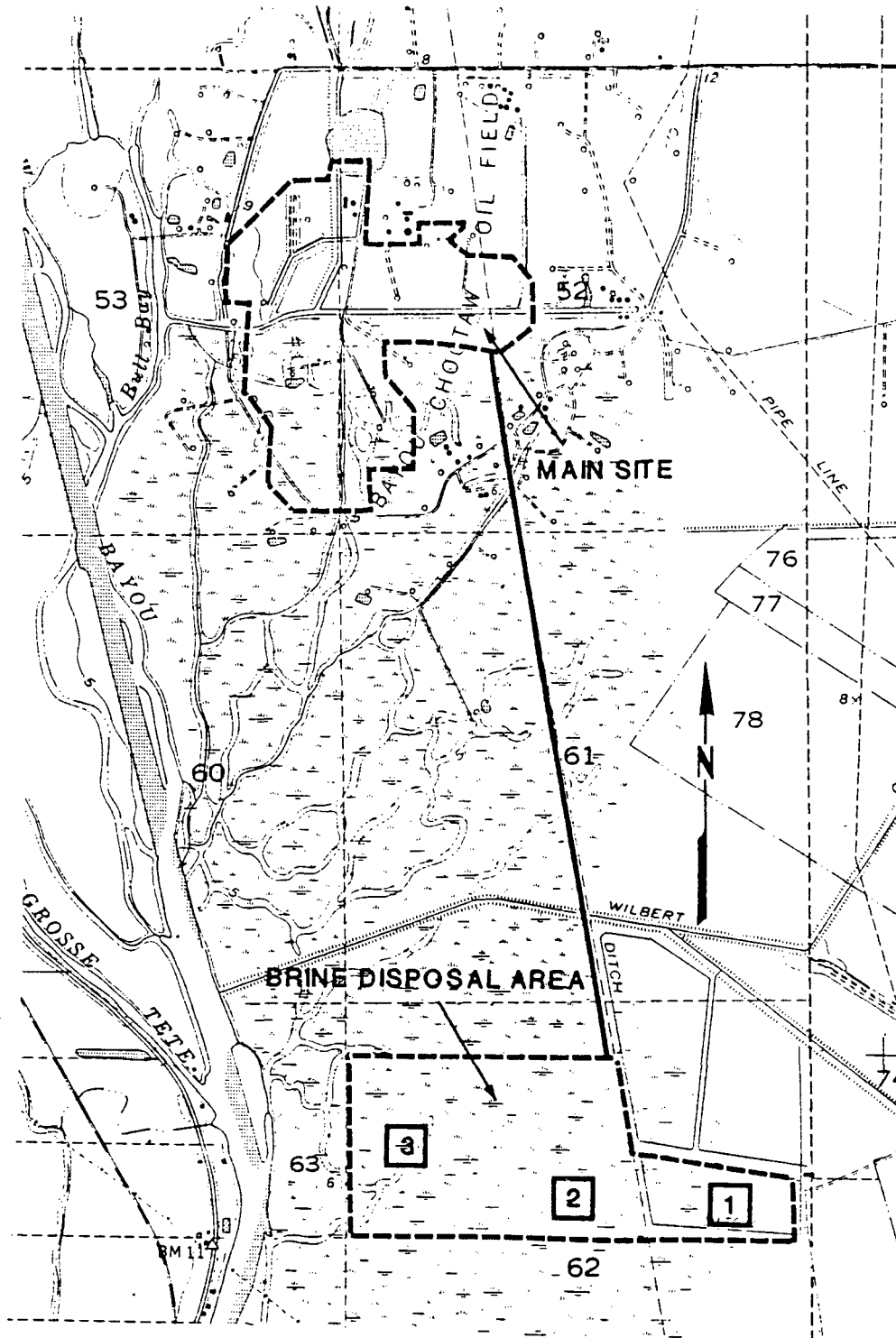


Figure C-1. Vicinity of Bayou Choctaw SPR Site from
U.S.G.S. 7.5 Minute Quadrangle Map for Addis, LA

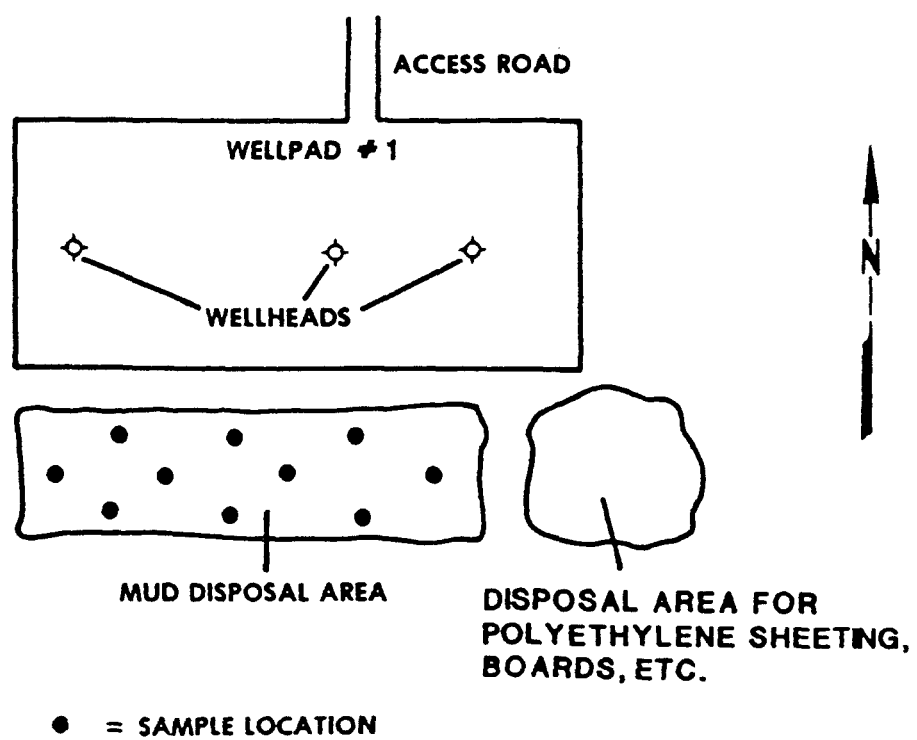


Figure C-2. Bayou Choctaw Mud Pit Sample Locations

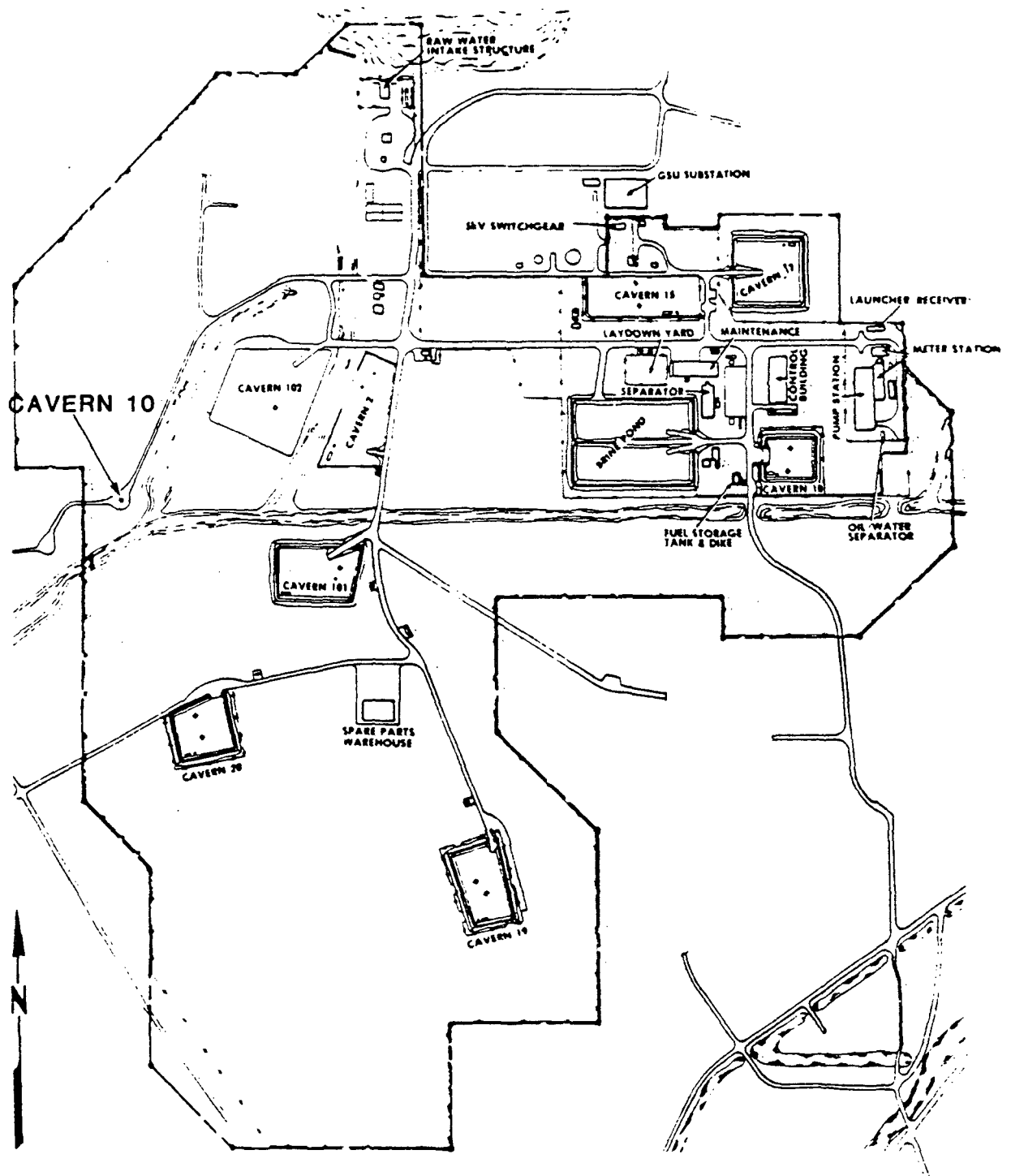


Figure C-3. Bayou Choctaw SPR Site

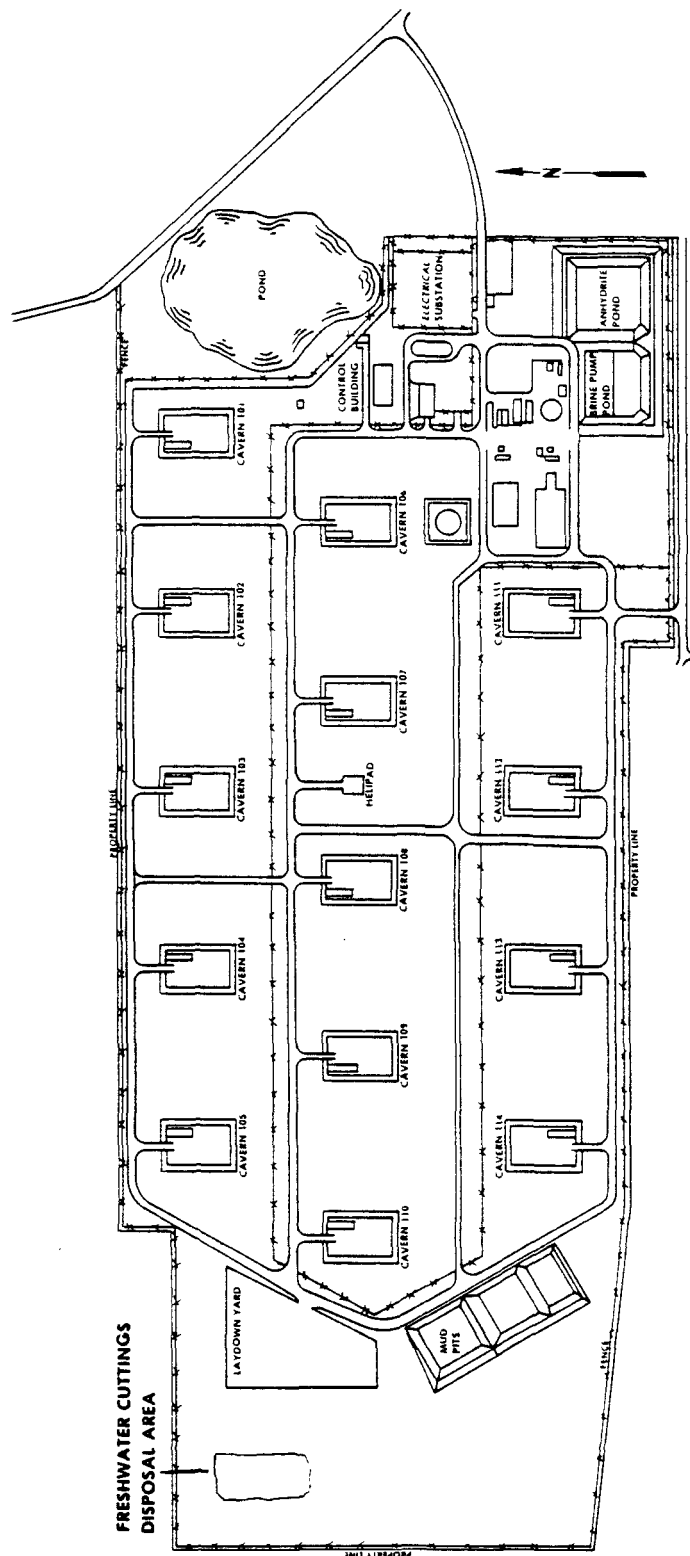


Figure C-4. Big Hill SPR Site

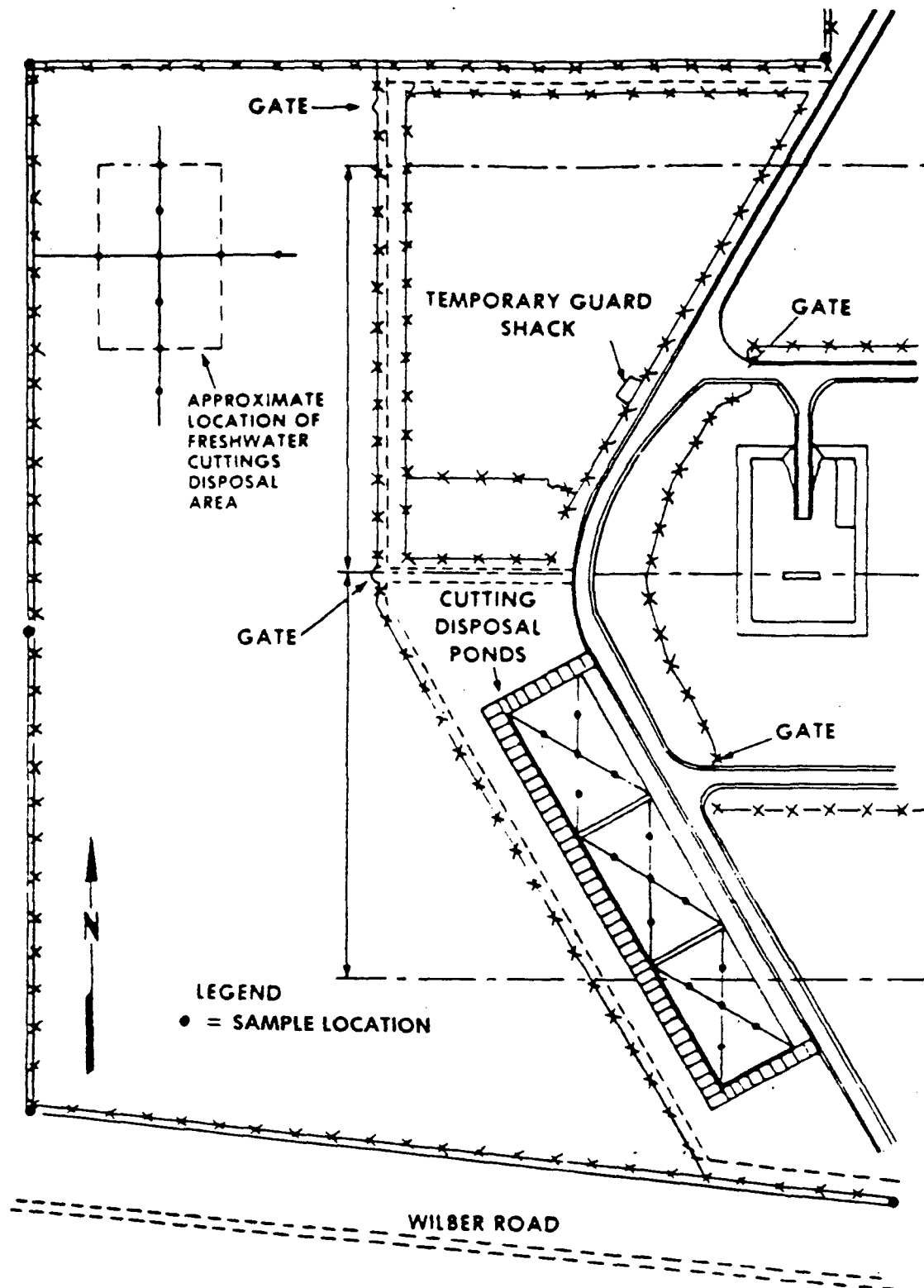
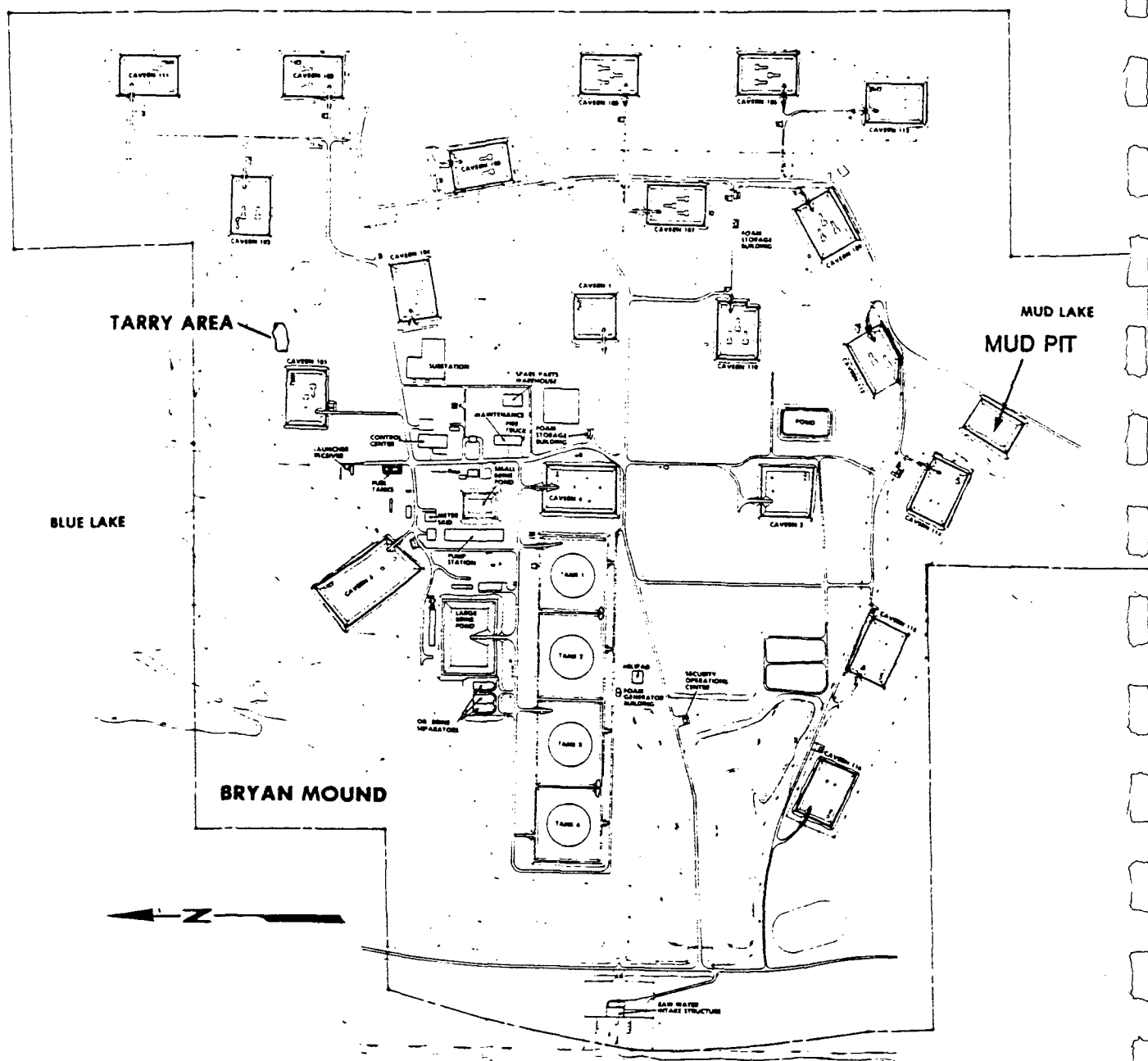


Figure C-5. Big Hill Cuttings Disposal Sample Locations



BRAZOS RIVER DIVERSION CHANNEL

Figure C-6. Bryan Mound SPR Site

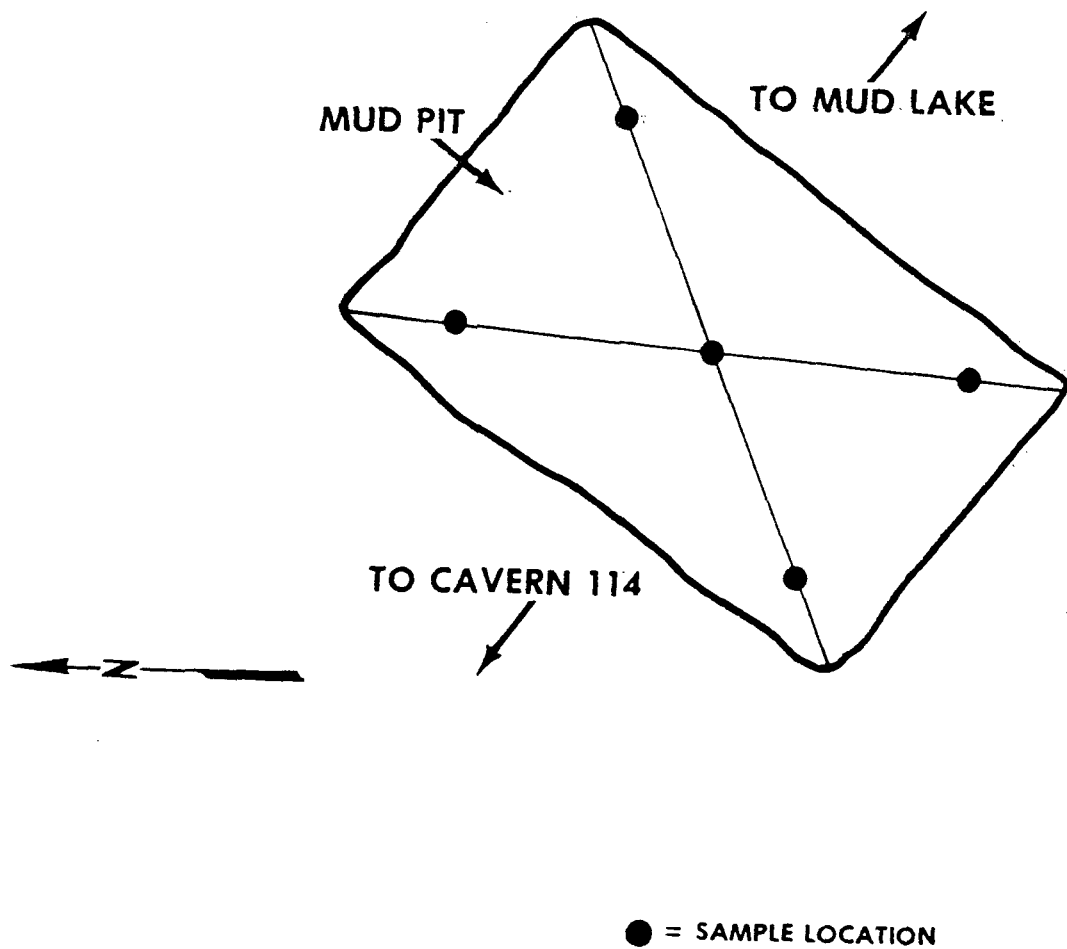


Figure C-7. Bryan Mound Mud Pit Sample Locations

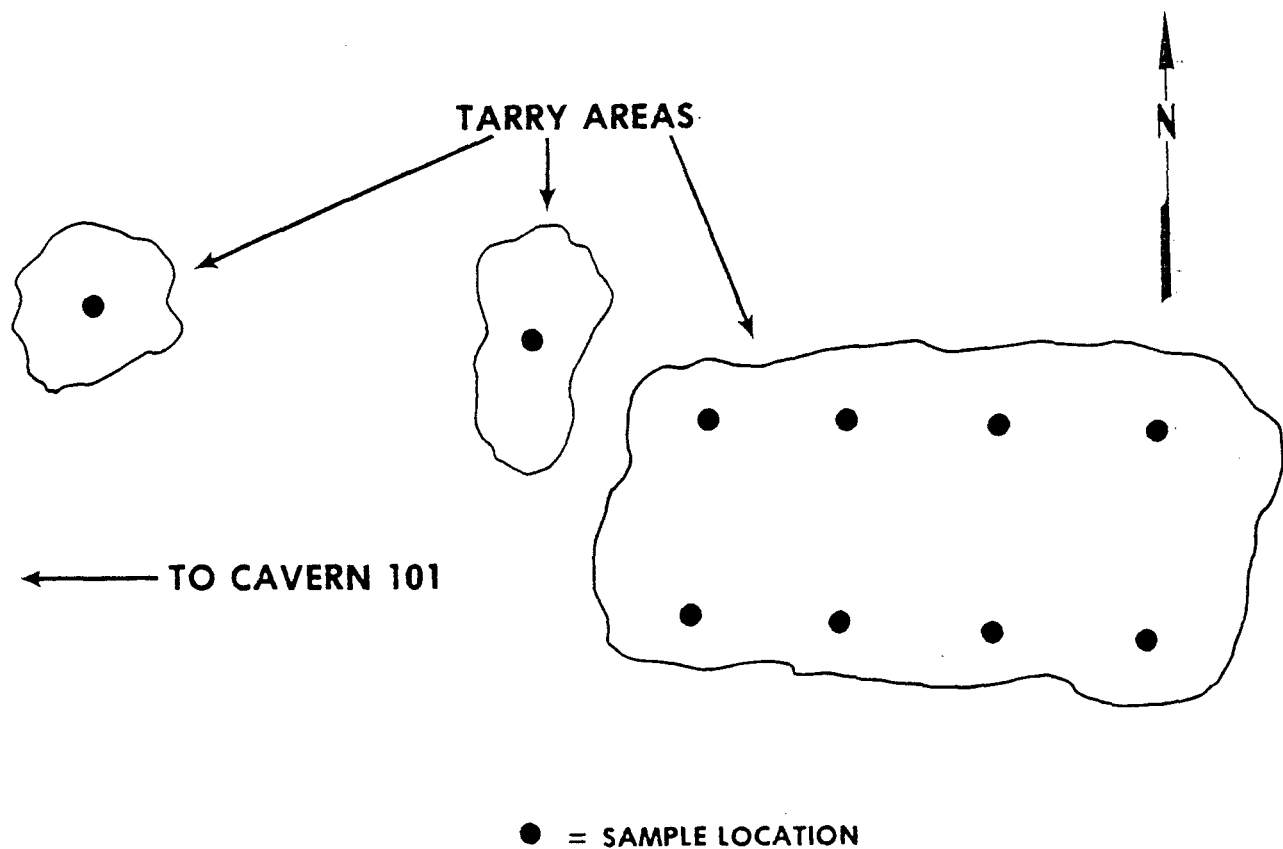


Figure C-8. Bryan Mound Tarry Area Sample Locations

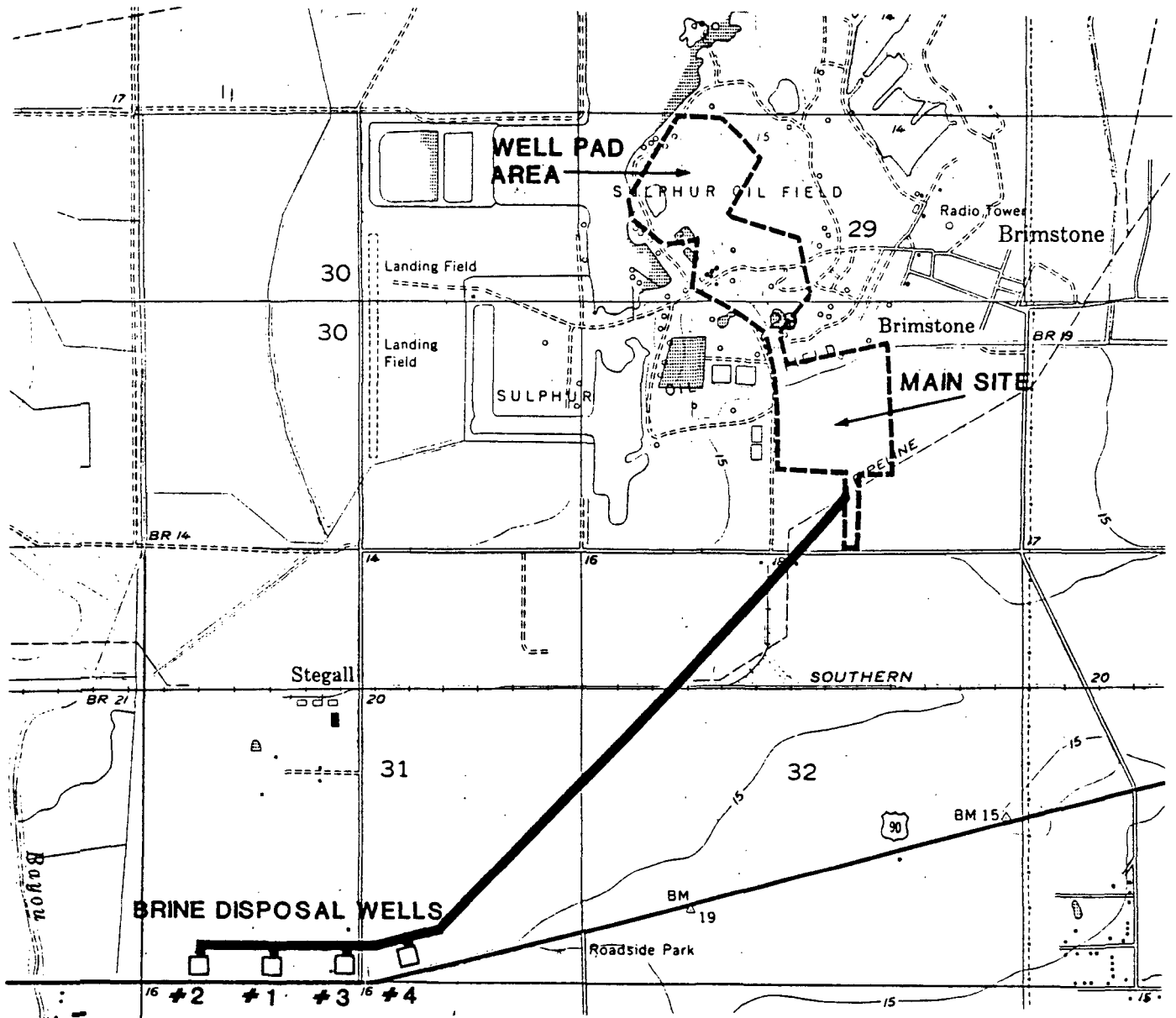


Figure C-9. Vicinity of Sulphur Mines SPR Site
From U.S.G.S. 7.5 Minute Quadrangle Maps for Sulphur and Brimstone, LA

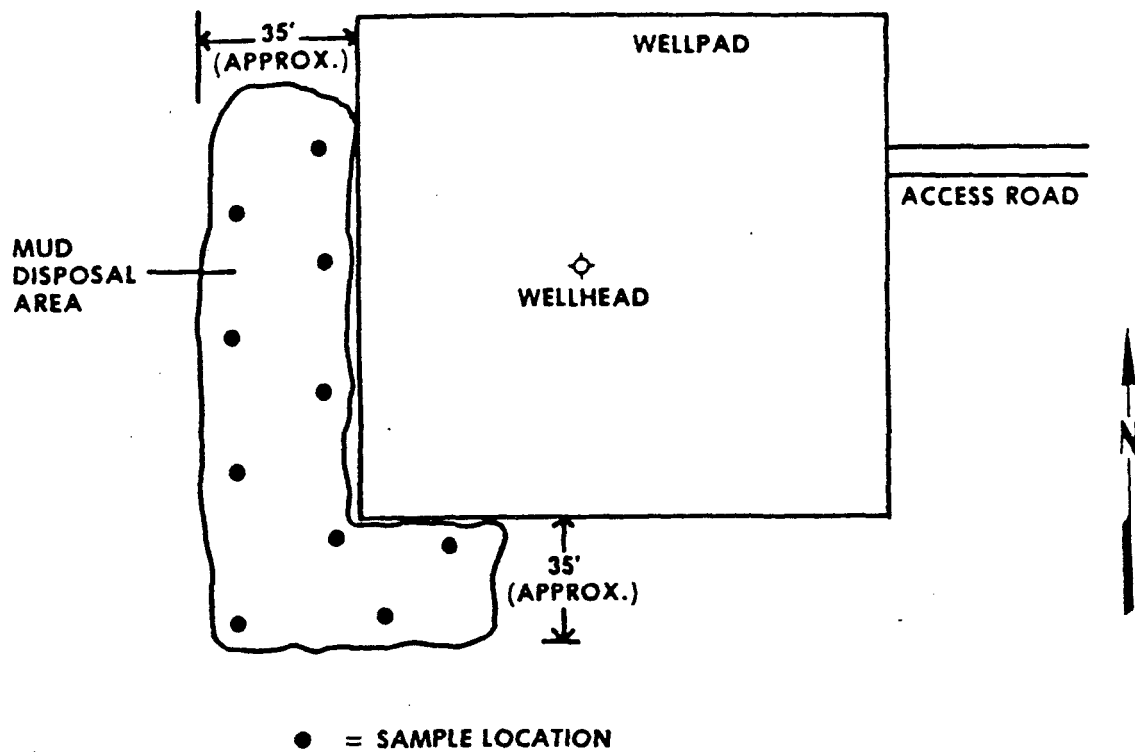


Figure C-10. Sulphur Mines Brine Disposal Well 3 Sample Locations

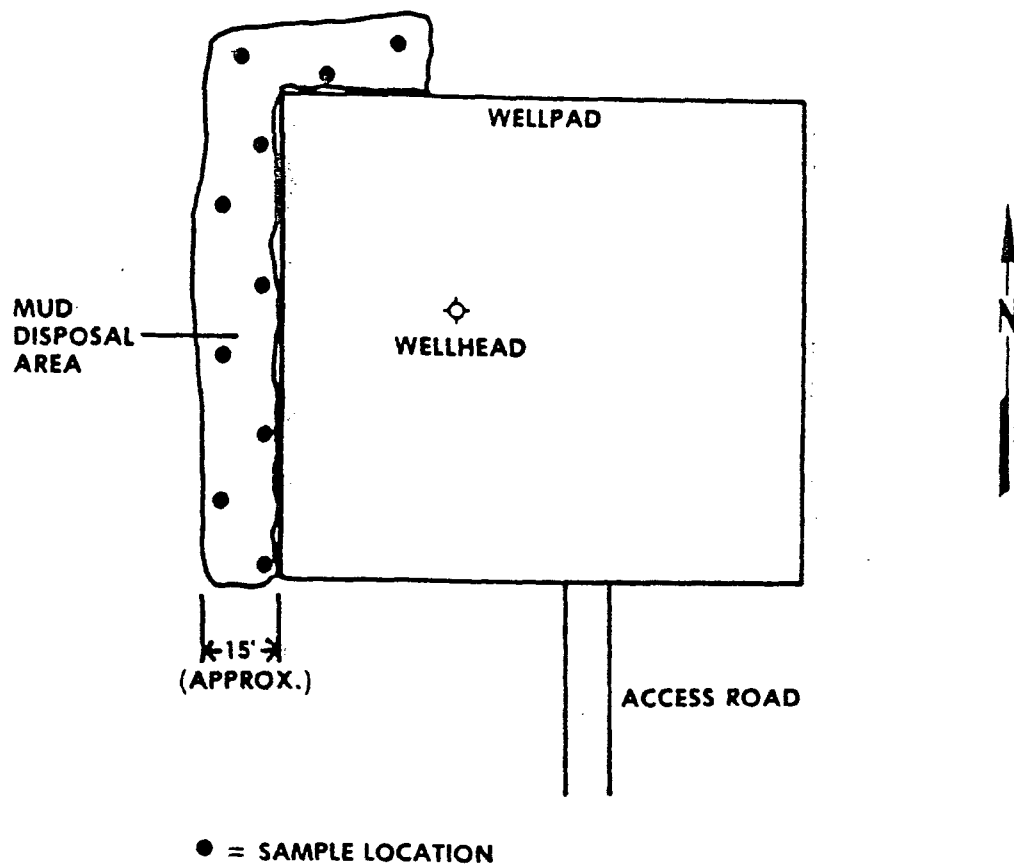


Figure C-11. Sulphur Mines Brine Disposal Well 4 Sample Locations

APPENDIX D
LABORATORY REPORTS

LABORATORY REPORT FOR BAYOU CHOCTAW

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES
2445 Florida Avenue
Kenner, Louisiana 70062
(504) 469-0333

LABORATORY REPORT

Prepared For: Boeing Petroleum Services, Inc.

Sample Description: 11 Borings

Laboratory Number: 86109907

Job Number: P-008888-0914

Date Received: 10/22/86

Sampled By: Client

Analyses Requested: See Below

RESULTS

Cavern 10

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.004 |
| Barium | 0.6 | 0.3 |
| Cadmium | 0.285 | 0.015 |
| Chromium | 0.39 | 0.15 |
| Lead | 89.4 | 1.5 |
| Mercury | 0.0036 | 0.0004 |
| Selenium | BDL | 0.004 |
| Silver | 0.42 | 0.03 |
| Sodium | 903 | 30 |
| Potassium | 234,000 | 1,500 |
| Chloride | 1,050 | 0.5 |
| pH (S.U.) | 13.7 | -- |

A

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | 0.004 | 0.002 |
| Barium | 0.7 | 0.1 |
| Cadmium | 0.010 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.11 | 0.05 |
| Mercury | 0.0006 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.01 | 0.01 |



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

Blank

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Sodium | BDL | 1.0 |
| Potassium | BDL | 0.01 |

Lab Blank

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.1 | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | BDL | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

B

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | 0.002 | 0.002 |
| Barium | 0.7 | 0.1 |
| Cadmium | 0.009 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.08 | 0.05 |
| Mercury | 0.0006 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.01 | 0.01 |

C

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | 0.002 | 0.002 |
| Barium | 0.8 | 0.1 |
| Cadmium | 0.009 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.22 | 0.05 |
| Mercury | 0.0012 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.02 | 0.01 |



**ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.**

C-Duplicate

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | 0.002 | 0.002 |
| Barium | 0.8 | 0.1 |
| Cadmium | 0.010 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.18 | 0.05 |
| Mercury | 0.0010 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.02 | 0.01 |

D

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | 0.005 | 0.002 |
| Barium | 0.8 | 0.1 |
| Cadmium | 0.005 | 0.005 |
| Chromium | 0.16 | 0.05 |
| Lead | 0.18 | 0.05 |
| Mercury | 0.0008 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.02 | 0.01 |

E

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>% Spike Recovery</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------------|-------------------|
| Arsenic | BDL | 78 | 0.002 |
| Barium | 0.8 | 120 | 0.1 |
| Cadmium | 0.011 | 130 | 0.005 |
| Chromium | BDL | 127 | 0.05 |
| Lead | 0.16 | 126 | 0.05 |
| Mercury | 0.0018 | 43 | 0.0002 |
| Selenium | BDL | 21 | 0.002 |
| Silver | 0.01 | 127 | 0.01 |

F

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | 0.004 | 0.002 |
| Barium | 0.6 | 0.1 |
| Cadmium | 0.009 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.14 | 0.05 |
| Mercury | 0.0018 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.01 | 0.01 |

G

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | 0.004 | 0.002 |
| Barium | 0.8 | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | 0.22 | 0.05 |
| Lead | 0.11 | 0.05 |
| Mercury | 0.0010 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

H

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | 0.002 | 0.002 |
| Barium | 0.3 | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.12 | 0.05 |
| Mercury | 0.0010 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

I

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | 0.005 | 0.002 |
| Barium | 0.2 | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.05 | 0.05 |
| Mercury | 0.0016 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

J

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.3 | 0.1 |
| Cadmium | 0.005 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0004 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

RDL: Required Detection Limit

BDL: Below Detection Limit

Client: Boeing Petroleum
Sample: Cavern 10

Date Extracted: 10/28/86
Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection Limit</u> ($\mu\text{g/l}$) |
|--------------|---|---|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:

Dibutylchloroendate Recovery % 39

HERBICIDE FRACTION

| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:

4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 100

RDL: Required Detection Limit

BDL: Below Detection Limit

** : Below Required Detection Limit, but Detected

DL : Diluted Out

B : Detected in Blank

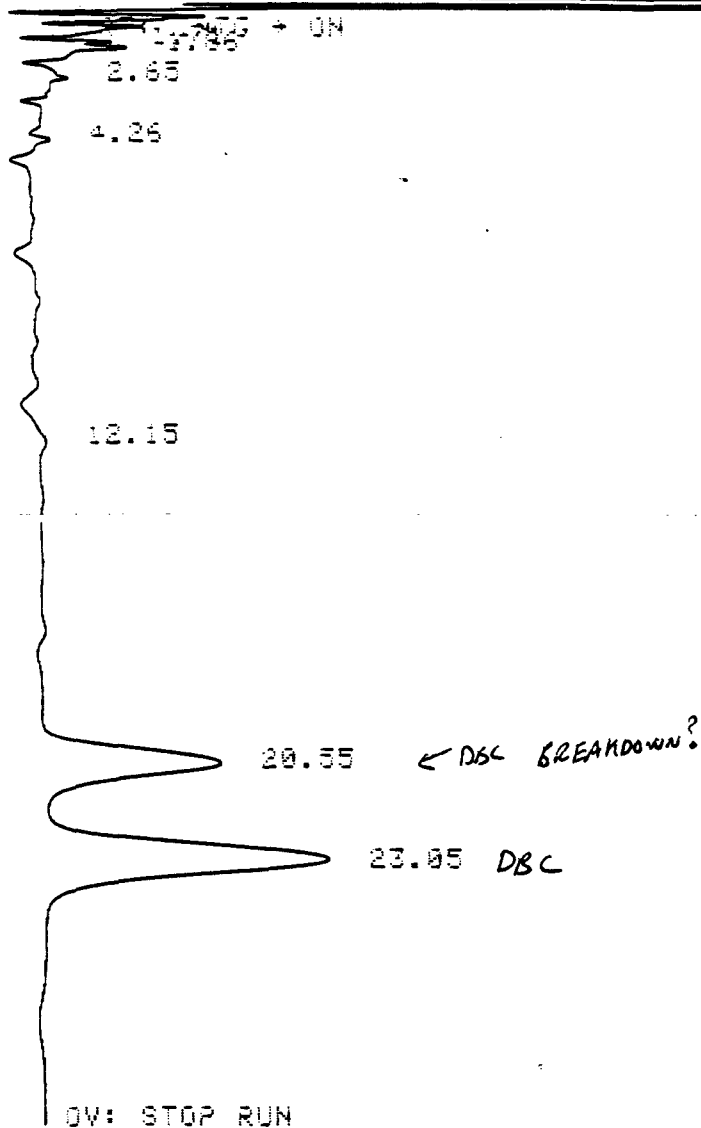
MS : Matrix Spike Compound

EIRA

ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

READY FOR INJECTION

RT: INTC + OFF



RUN # 81 PESTICIDE ANALYSIS LAB #: 109907
 QUANTITATION RUN CLIENT: BPS-SPR
 COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401
SAMPLE ID: CAVERN 10 VOL. INJ.: 3 µL

【hp】 5880A MANUAL INJECTION @ 17:29 NOV 5, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|-------|----------|------|--------|
| 1.86 | 5294.27 | VV | 5.745 |
| 2.65 | 3729.08 | VV | 4.046 |
| 4.26 | 3172.74 | VP | 3.443 |
| 20.55 | 28453.90 | BV | 30.875 |
| 23.05 | 31507.80 | VB | 33.891 |

TOTAL AREA = 92157.80
MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

5.30 2,4-DB

RUN # 49

HERBICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: SPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: CAVERN 10

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 14:26 NOV 4, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 5.30 | 169615.00 | SB | 100.000 |

TOTAL AREA = 169615.00

MULTIPLIER = 1

Client: Boeing Petroleum

Sample: A

Date Extracted: 10/28/86

Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:

Dibutylchloroendate Recovery % 114

HERBICIDE FRACTION

| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:

4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 103

RDL: Required Detection Limit

BDL: Below Detection Limit

** : Below Required Detection Limit, but Detected

DL : Diluted Out

B : Detected in Blank

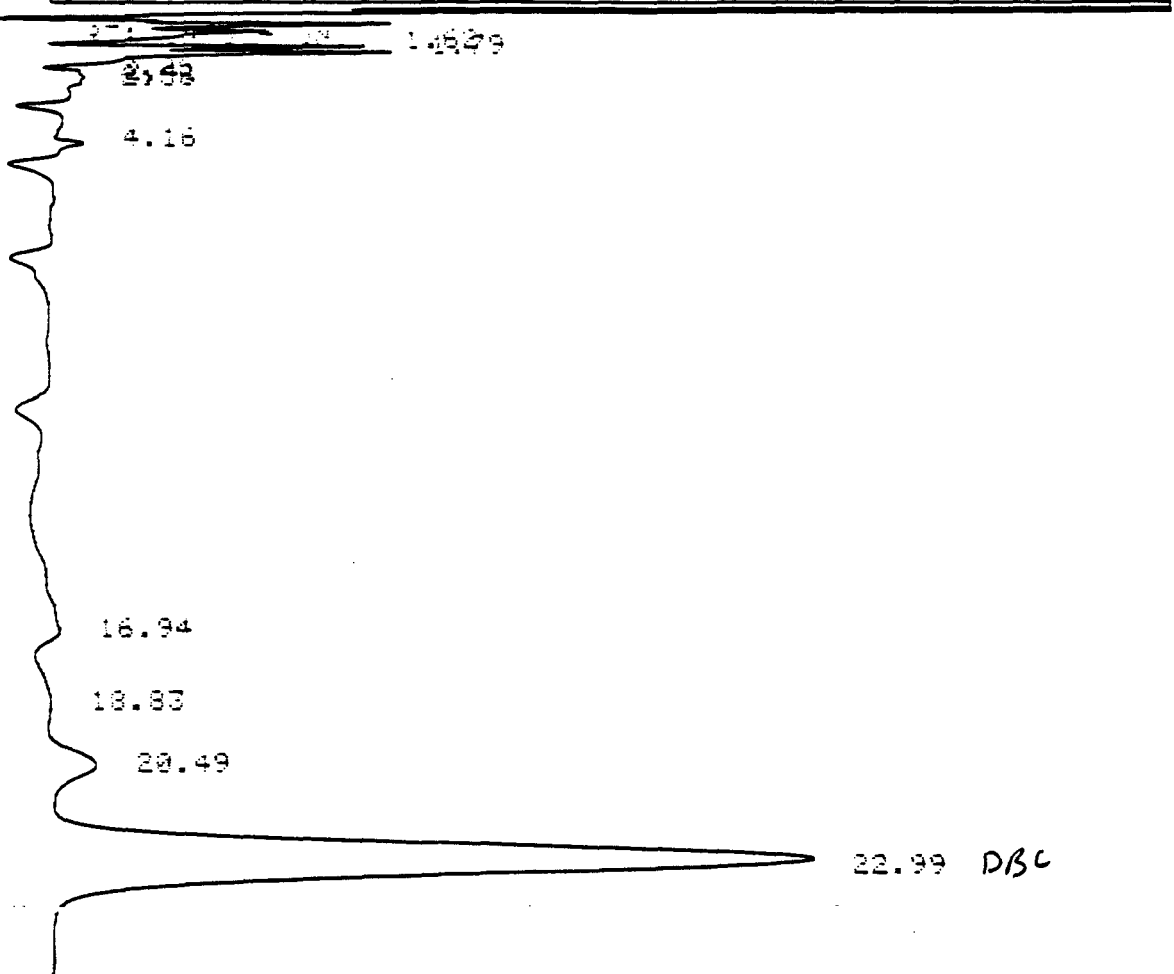
MS : Matrix Spike Compound

EIRA

ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

READY FOR INJECTION

RT: INTG + OFF



RUN # 68

PESTICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: A

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 10:53 NOV 5, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.62 | 5912.32 | BV | 3.010 |
| 1.79 | 10803.50 | VP | 5.500 |
| 2.26 | 727.13 | PV | 0.370 |
| 2.41 | 1482.57 | VV | 0.755 |
| 2.56 | 1445.43 | VV | 0.736 |
| 4.16 | 3394.62 | SP | 1.728 |
| 16.94 | 3924.87 | SP | 1.998 |
| 18.83 | 4146.37 | PH | 2.111 |
| 20.49 | 13961.50 | HH | 7.108 |
| 22.99 | 150615.00 | HH | 76.683 |

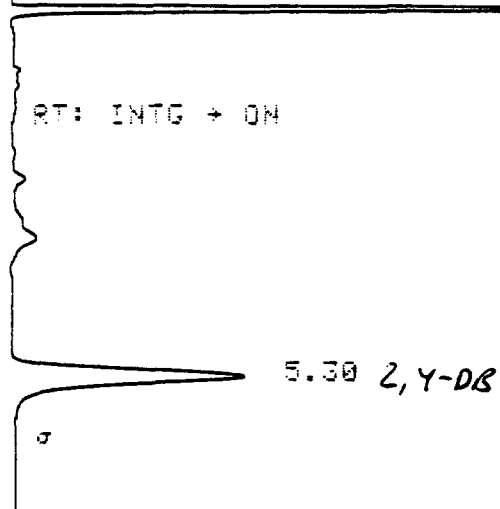
TOTAL AREA = 196413.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG → OFF

RT: INTG → ON



RUN # 36

HERBICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: A

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 12:14 NOV 4, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 5.30 | 175013.00 | BH | 100.000 |

TOTAL AREA = 175013.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: B

Date Extracted: 10/28/86
Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:
Dibutylchloroendate Recovery % 100

HERBICIDE FRACTION

| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:
4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 105

RDL: Required Detection Limit
BDL: Below Detection Limit
** : Below Required Detection Limit, but Detected
DL : Diluted Out
B : Detected in Blank
MS : Matrix Spike Compound

RT: INTG + OFF.

2.37

4.12

16.96

20.39

22.87 DBC

ABSORPTIME = 25.68 MIN

RUN # 69

PESTICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS-BPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: 8

VOL. INJ.: 3 AL

INP 5880R MANUAL INJECTION @ 11:20 NOV 5, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 16.96 | 9864.30 | SB | 6.568 |
| 20.39 | 8039.91 | SV | 5.353 |
| 22.87 | 132282.00 | VB | 88.079 |

TOTAL AREA = 150187.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

5.31 2,4-DB

RUN # 37

HERBICIDE ANALYSIS
QUANTITATION RUN

LAB #: 109907

CLIENT: BPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: B

VOL. INJ.: 3 µL

MANUAL INJECTION @ 12:22 NOV 4, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 5.31 | 177495.00 | BB | 100.000 |

TOTAL AREA = 177495.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: C

Date Extracted: 10/28/86
Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:

Dibutylchlorendate Recovery % 98

HERBICIDE FRACTION

| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:

4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 79

RDL: Required Detection Limit

BDL: Below Detection Limit

** : Below Required Detection Limit, but Detected

DL : Diluted Out

B : Detected in Blank

MS : Matrix Spike Compound



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

READY FOR INJECTION

RT: INTG + OFF

1.61
1.75
2.38
2.82
4.13
5.21

18.78

20.37

22.88 DBL

RUN # 72

PESTICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: SPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: .C

VOL. INJ.: 3 µL

MANUAL INJECTION @ 12:42 NOV 5, 1986

AREA %

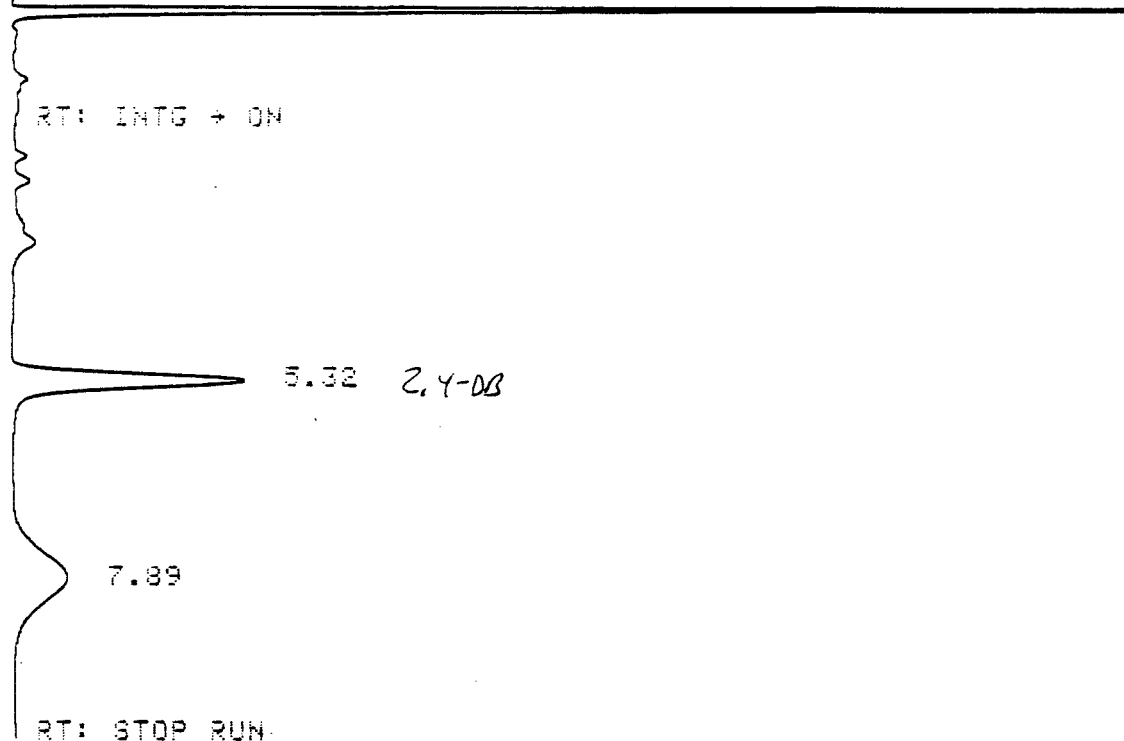
| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.61 | 3936.74 | BV | 2.128 |
| 1.75 | 6549.07 | VV | 3.540 |
| 2.38 | 9471.08 | VV | 5.119 |
| 2.82 | 8887.92 | VV | 4.884 |
| 4.13 | 12371.90 | VP | 6.687 |
| 5.21 | 2872.59 | PS | 1.553 |
| 18.78 | 1368.43 | SS | 0.746 |
| 20.37 | 6740.01 | SP | 3.643 |
| 22.88 | 129827.00 | PS | 70.168 |

TOTAL AREA = 183023.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF



RUN # 56

HERBICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: .C

VOL. INJ.: 3 µL

[HP] 5880A MANUAL INJECTION @ 16:18 NOV 4, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|--------|
| 5.32 | 159598.00 | BB | 54.521 |
| 7.89 | 133129.00 | BB | 45.479 |

TOTAL AREA = 292727.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: C-Duplicate

Date Extracted: 10/28/86
Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection Limit</u> ($\mu\text{g/l}$) |
|--------------|---|---|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:

Dibutylchloroendate Recovery % 94

HERBICIDE FRACTION

| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:

4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 125

RDL: Required Detection Limit
BDL: Below Detection Limit
** : Below Required Detection Limit, but Detected
DL : Diluted Out
B : Detected in Blank
MS : Matrix Spike Compound



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.15

17.06

20.42

22.92 DBC

QV: STOP RUN

RUN # 73

PESTICIDE ANALYSIS

LAB.#: 109907

QUANTITATION RUN

CLIENT: SPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: .C (DUPL.)

VOL. INJ.: 3 AL

【5P】 5880A MANUAL INJECTION @ 13:13 NOV 5, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 17.06 | 2518.87 | BB | 1.897 |
| 20.42 | 6463.00 | BP | 4.868 |
| 22.92 | 123787.00 | PS | 93.235 |

TOTAL AREA = 132769.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

3.50

4.42

5.29 2, Y-DB

RUN # 41 HERBICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: SPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: C (DUPL.)

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 12:58 NOV 4, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|--------|
| 3.50 | 35937.60 | BV | 6.099 |
| 4.42 | 341207.00 | VV | 57.902 |
| 5.29 | 212134.00 | VR | 35.999 |

TOTAL AREA = 589278.00

MULTIPLIER = 1

COT

Client: Boeing Petroleum
Sample: D

Date Extracted: 10/28/86
Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:

Dibutylchlorendate Recovery % 102

HERBICIDE FRACTION

| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:

4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 102

RDL: Required Detection Limit

BDL: Below Detection Limit

** : Below Required Detection Limit, but Detected

DL : Diluted Out

B : Detected in Blank

MS : Matrix Spike Compound

EIRA

ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

READY FOR INJECTION

RT: INTG + OFF

INTG + ON 1.65

3.43

4.19

17.20

20.60

23.12 DBC

RUN # 74

PESTICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS-SPR

COLUMN: 5 FT X 1/8 IN 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: 0

VOL. INJ.: 3 AL

[HP] 5880A MANUAL INJECTION @ 14:05 NOV 5, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.65 | 9989.83 | BP | 6.402 |
| 17.20 | 2636.46 | BP | 1.711 |
| 20.60 | 6783.33 | BP | 4.402 |
| 23.12 | 134701.00 | PS | 87.405 |

TOTAL AREA = 154111.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

5.29 2,4-D

RUN # 40 HERBICIDE ANALYSIS LAB #: 109987
QUANTITATION RUN CLIENT: BPS-SPR
COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401
SAMPLE ID: D VOL. INJ.: 3 µL

5880A MANUAL INJECTION @ 12:50 NOV 4, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 5.29 | 173028.00 | VB | 100.000 |

TOTAL AREA = 173028.00
MULTIPLIER = 1

Client: Boeing Petroleum
Sample: E

Date Extracted: 10/28/86
Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:

Dibutylchlorendate Recovery % 88

HERBICIDE FRACTION

| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:

4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 106

RDL: Required Detection Limit

BDL: Below Detection Limit

** : Below Required Detection Limit, but Detected

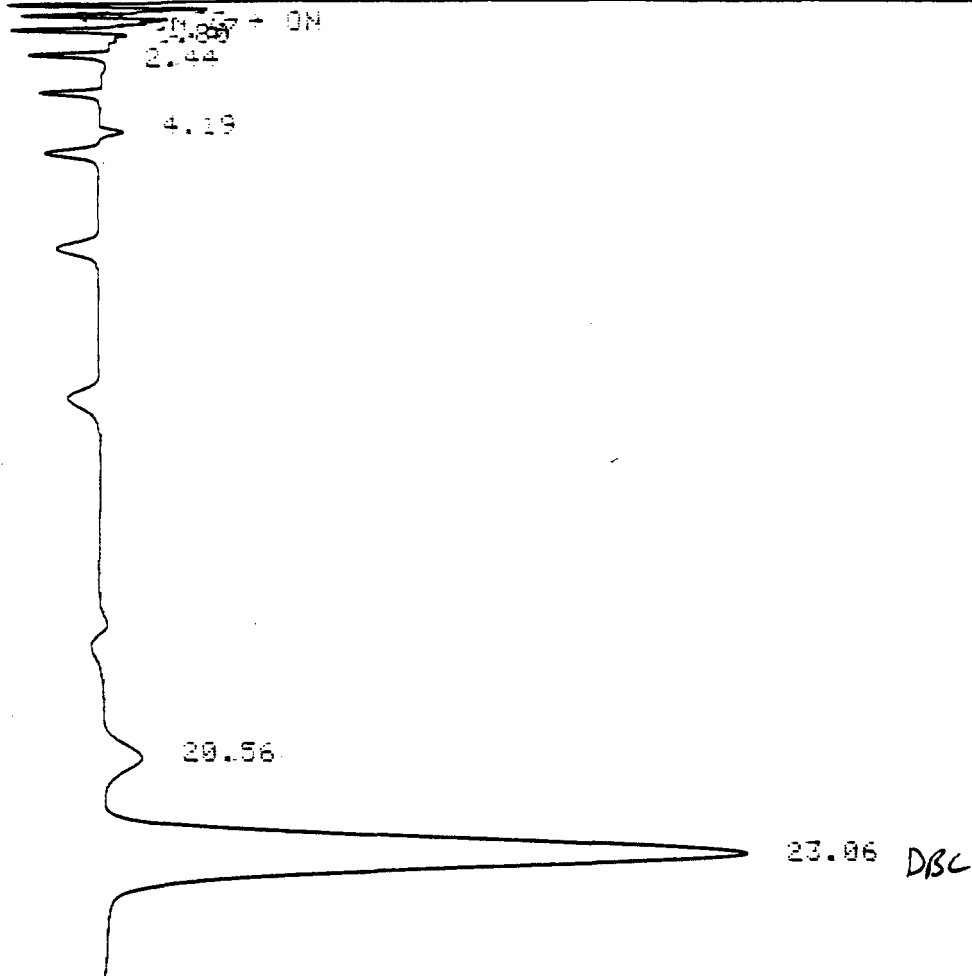
DL : Diluted Out

B : Detected in Blank

MS : Matrix Spike Compound

READY FOR INJECTION

RT: INTG + OFF



RUN # 75 PESTICIDE ANALYSIS LAB #: 100007
QUANTITATION RUN CLIENT: BPS-SPR
COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401
SAMPLE ID: .E VOL. INJ.: 3 µL

MANUAL INJECTION @ 14:33 NOV. 5, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 2.44 | 3563.36 | PV | 2.860 |
| 20.56 | 5533.79 | SP | 4.442 |
| 23.06 | 115475.00 | VB | 92.697 |

TOTAL AREA = 124572.00
MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

5.31 2,4-DB

9.12

RUN # 43

HERBICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: .2

VOL. INJ.: 3 AL

MANUAL INJECTION @ 13:18 NOV 4, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|--------|
| 5.31 | 178901.00 | BB | 29.772 |
| 9.12 | 422001.00 | A BH | 70.228 |

TOTAL AREA = 600902.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: F

Date Extracted: 10/28/86
Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:

Dibutylchlorendate Recovery % 91

HERBICIDE FRACTION

| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:

4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 103

RDL: Required Detection Limit

BDL: Below Detection Limit

** : Below Required Detection Limit, but Detected

DL : Diluted Out

B : Detected in Blank

MS : Matrix Spike Compound

EIRA

ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

READY FOR INJECTION

STA INTG = OFF

INTEG = ON
2.36

4.13

17.86

20.44

22.94 *DISC*

RUN # 76

PESTICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: F

VOL. INJ.: 3 µL

[HP] 5880A MANUAL INJECTION @ 15:00 NOV 5, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 20.44 | 6576.29 | BV | 5.184 |
| 22.94 | 120278.00 | VB | 94.816 |

TOTAL AREA = 126854.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

5.29 2, 4-DA

RT: STOP RUN

RUN # 44

HERBICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS-SPR

COLUMN: 6 FT X 4 MM. 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: F

VOL. INJ.: 3 AL

【SP】 5880A MANUAL INJECTION @ 13:29 NOV 4, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 5.29 | 174570.00 | BB | 100.000 |

TOTAL AREA = 174570.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: G

Date Extracted: 10/28/86
Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:

Dibutylchlorendate Recovery % 90

HERBICIDE FRACTION

| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:

4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 70

RDL: Required Detection Limit

BDL: Below Detection Limit

** : Below Required Detection Limit, but Detected

DL : Diluted Out

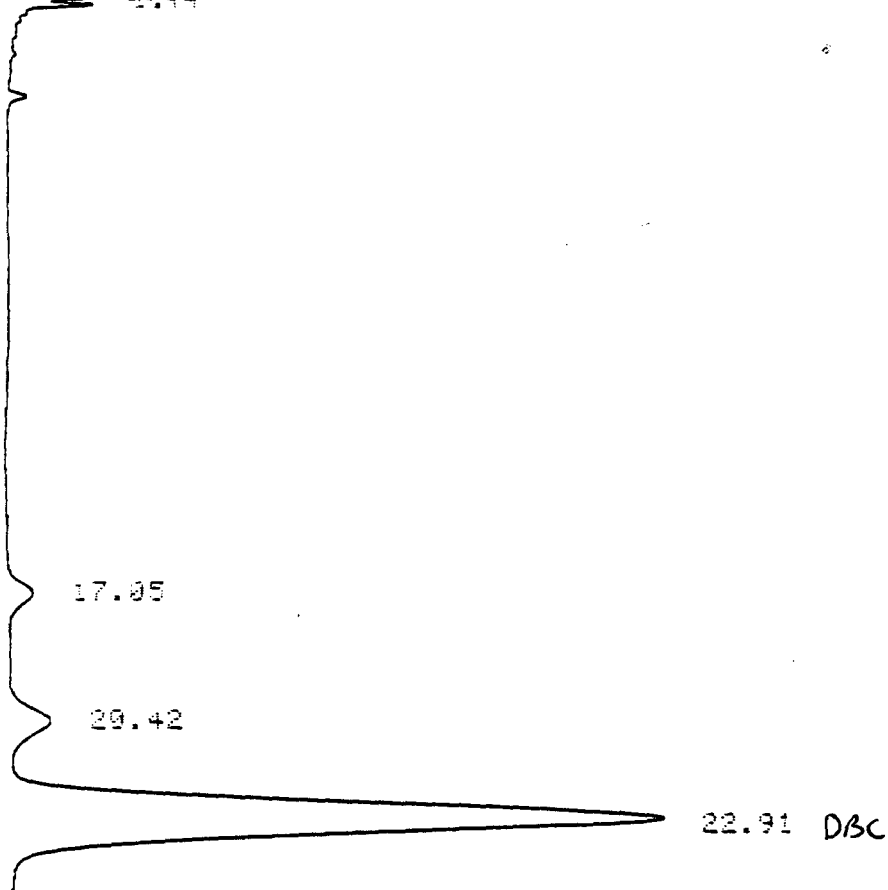
B : Detected in Blank

MS : Matrix Spike Compound

READY FOR INJECTION

RT: INTG + OFF

INTEG + ON



RUN # 77 PESTICIDE ANALYSIS LAB #: 109907
QUANTITATION RUN CLIENT: SPS-SPR
COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401
SAMPLE ID: G VOL. INJ.: 3 µL

【HP】 5880A MANUAL INJECTION @ 15:26 NOV 5, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 17.05 | 3602.01 | SV | 2.803 |
| 20.42 | 6615.14 | SH | 5.147 |
| 22.91 | 118297.00 | R HH | 92.050 |

TOTAL AREA = 129514.00
MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.07

5.30 2,4-DB

RT: STOP RUN

RUN # 45

HERBICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: SPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: G

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 13:40 NOV 4, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|--------|
| 4.07 | 13546.50 | SV | 10.234 |
| 5.30 | 118824.00 | SB | 89.766 |

TOTAL AREA = 132370.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: H

Date Extracted: 10/28/86
Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection Limit</u> ($\mu\text{g/l}$) |
|--------------|---|---|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:

Dibutylchloredate Recovery % 94

HERBICIDE FRACTION

| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:

4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 89

RDL: Required Detection Limit
BDL: Below Detection Limit
** : Below Required Detection Limit, but Detected
DL : Diluted Out
B : Detected in Blank
MS : Matrix Spike Compound

READY FOR INJECTION

BT: INTG + OFF

2.3855 + ON
2.43
3.45
4.22

17.22

20.67

23.20 DBC

OV: STOP RUN

RUN # 78

PESTICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: H

VOL. INJ.: 3 µL

[AP] 5280A MANUAL INJECTION @ 15:52 NOV 5, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 20.67 | 6972.99 | BV | 5.316 |
| 23.20 | 124187.00 | VS | 94.684 |

TOTAL AREA = 131160.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

5.28 24-08

RUN # 54

HERBICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: H

VOL. INJ: 10 µL

HP 5890A MANUAL INJECTION @ 15:58 NOV 4, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 5.28 | 151020.00 | 88 | 100.000 |

TOTAL AREA = 151020.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: I

Date Extracted: 10/28/86
Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:
Dibutylchlorendate Recovery % 98

HERBICIDE FRACTION

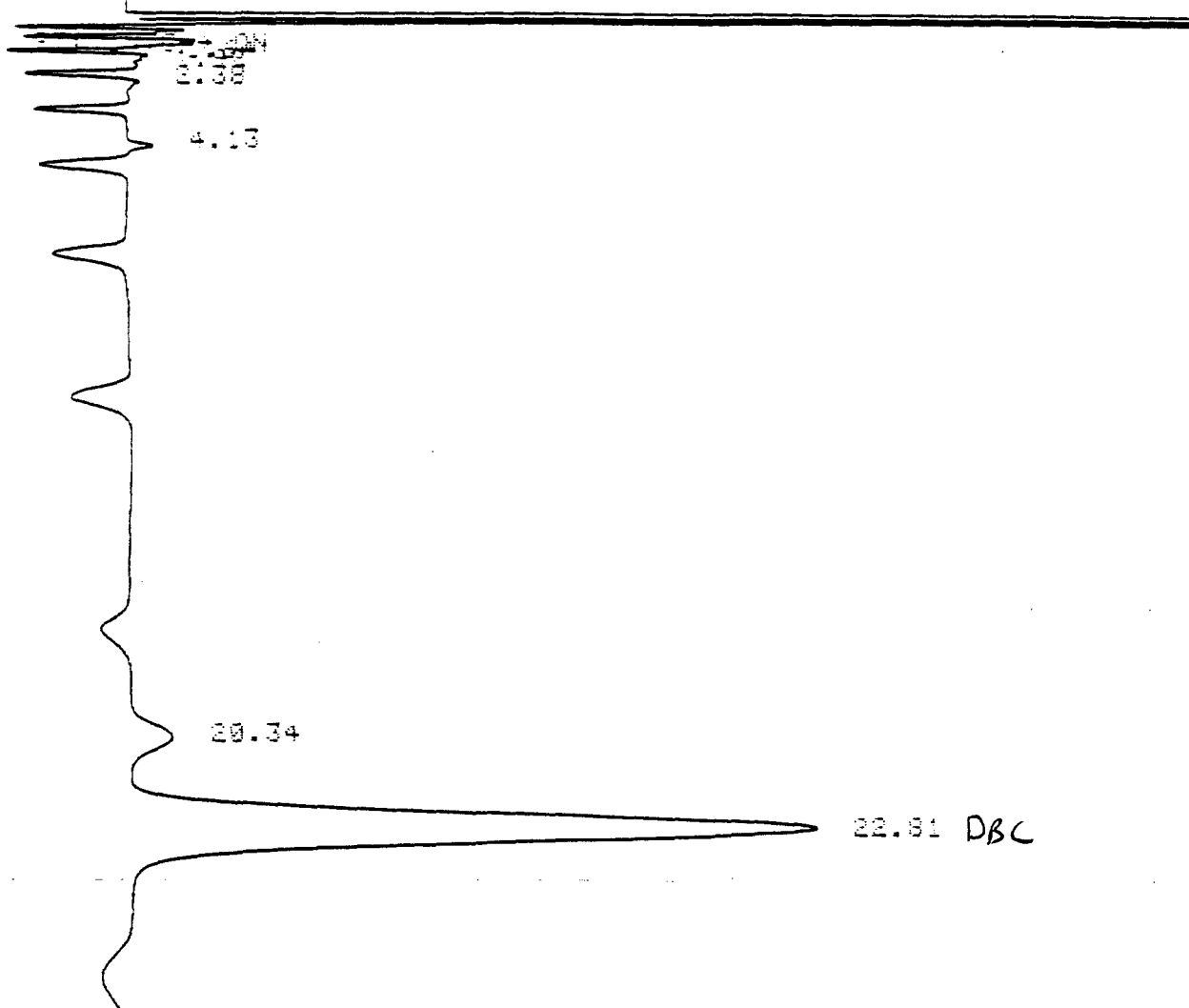
| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:
4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 98

RDL: Required Detection Limit
BDL: Below Detection Limit
** : Below Required Detection Limit, but Detected
DL : Diluted Out
B : Detected in Blank
MS : Matrix Spike Compound

READY FOR INJECTION

BT: INTG + OFF



RUN # 79

PESTICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: I

VOL. INJ.: 3 AL

MANUAL INJECTION @ 16:28 NOV 5, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.64 | 3650.49 | SV | 2.420 |
| 1.92 | 5493.37 | VP | 3.641 |
| 4.13 | 5234.96 | SP | 3.470 |
| 20.34 | 6754.82 | BB | 4.477 |
| 22.81 | 129738.00 | BB | 85.992 |

TOTAL AREA = 150871.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTEG → OFF

RT: INTEG → ON

5.30 2,4-Ds

RT: STOP RUN

RUN # 47

HERBICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: SPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: I

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 14:05 NOV 4, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 5.30 | 166216.00 | BB | 100.000 |

TOTAL AREA = 166216.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: J

Date Extracted: 10/28/86
Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:
Dibutylchlorendate Recovery % 98

HERBICIDE FRACTION

| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:
4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 103

RDL: Required Detection Limit
BDL: Below Detection Limit
** : Below Required Detection Limit, but Detected
DL : Diluted Out
B : Detected in Blank
MS : Matrix Spike Compound

READY FOR INJECTION

RT: INTG + OFF

2.37

4.13
5.20

16.88

20.41

22.90 DBC

OV: STOP RUN

RUN # 80

PESTICIDE ANALYSIS
QUANTITATION RUN

LAB #: 109907

CLIENT: BPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: J

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 16:56 NOV 5, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 2.37 | 2933.91 | BV | 2.071 |
| 4.13 | 2729.64 | BP | 1.927 |
| 20.41 | 6690.60 | BV | 4.722 |
| 22.90 | 129325.00 | VB | 91.280 |

TOTAL AREA = 141679.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

5.30 2,4-DB

RUN # 48

HERBICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS-SPR

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: J

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 14:19 NOV 4, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 5.30 | 175256.00 | 88 | 100.000 |

TOTAL AREA = 175256.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Blank

Date Extracted: 10/28/86
Date Analyzed: 11/05/86

PESTICIDE FRACTION/PCB

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection Limit</u> ($\mu\text{g/l}$) |
|--------------|---|---|
| Gamma-BHC | BDL | 5.00 |
| Endrin | BDL | 10.00 |
| Methoxychlor | BDL | 50.00 |
| Toxaphene | BDL | 100.00 |

SURROGATE:
Dibutylchloroendate Recovery % 107

HERBICIDE FRACTION

| | | |
|-------------------|-----|----|
| 2,4-D | BDL | 65 |
| 2,4,5-TP (Silvex) | BDL | 20 |

SURROGATE:
4-(2-4-Dichlorophenoxy)butyric Acid Recovery % 94

RDL: Required Detection Limit
BDL: Below Detection Limit
** : Below Required Detection Limit, but Detected
DL : Diluted Out
B : Detected in Blank
MS : Matrix Spike Compound



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

RT: 1.69 + OFF

1.69 + ON

2.94

4.27

17.41

19.34

20.99

23.54 DBC

RUN # 67

PESTICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: SPS-SPR

COLUMN: 6 FT X 1/8 IN 1.5% QP-2250/1.05% QP-2401

SAMPLE ID: BLANK

VOL. INJ.: 3 µL

EXP: 5880A MANUAL INJECTION @ 10:24 NOV 5, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.69 | 2600.24 | SV | 1.524 |
| 1.81 | 1404.04 | VB | 0.823 |
| 1.99 | 1759.54 | SP | 1.031 |
| 2.94 | 2363.20 | BP | 1.385 |
| 4.27 | 5374.51 | BP | 3.150 |
| 17.41 | 7591.43 | BP | 4.449 |
| 19.34 | 1501.66 | PB | 0.880 |
| 20.99 | 7374.52 | SV | 4.322 |
| 23.54 | 140652.00 | VB | 82.435 |

TOTAL AREA = 170622.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

5.30 2,4-DB

RT: STOP RUN

RUN # 35

HERBICIDE ANALYSIS

LAB #: 109907

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: BLANK

VOL. INJ.: 3 AL

[HP] 5880A MANUAL INJECTION @ 11:57 NOV 4, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 5.30 | 159930.00 | SB | 100.000 |

TOTAL AREA = 159930.00

MULTIPLIER = 1

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES
2445 Florida Avenue
Kenner, Louisiana 70062
(504) 469-0333

METHODS

Inorganic Analyses on Water and Wastewater:

Standard Methods for the Evaluation of Water and Wastewater, APHA, AWWA, WPCF:
16th Edition, 1985.

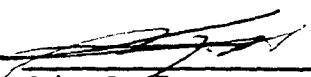
Soils, Sediments and Hazardous Waste Evaluation Procedures:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846,
U.S.E.P.A. Second Edition Revised April, 1984..

Organic Analyses on Water and Wastewater:

"Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", 40
CFR Part 136, Appendix A., U.S.E.P.A, Amended June 30, 1986.


Other methods if used are referenced with analytical results..



John R. Troost,
Manager of Analytical Services

Date

11/18/86



Thomas E. Orr,
Quality Assurance Coordinator

Date

11/18/86

LABORATORY REPORT FOR BIG HILL CUTTINGS DISPOSAL
PONDS AND FRESHWATER CUTTINGS DISPOSAL AREA

SAMPLING REPORT
FOR
BOEING PETROLEUM SERVICES, INC.

Prepared by
ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC.
2445 Florida Avenue
Kenner, Louisiana 70062

June, 1986

On May 27 and 28, 1986, four drill cuttings disposal areas at the Big Hill Strategic Petroleum Reserve site were sampled. There were three unconsolidated saltwater drill cuttings ponds and one backfilled freshwater cuttings area. A total of twenty-four samples were collected, nine from the freshwater cuttings area (ID numbers CER-BH-F1 through CER-BH-F9) and fifteen from the saltwater cuttings area, five from each of the three ponds (ID numbers CER-BH-C1 through CER-BH-C15). In addition, composites for each of the four areas were made from the corresponding samples.

The freshwater cuttings area sampling began on May 27, 1986 at 4:00 p.m. and was completed on May 28, 1986 at 9:30 a.m. The sampling grid was located in a north-south, east-west orientation. Distances between sampling points were approximately 75 feet and 100 feet, respectively. The general spoil profile was found to be a dark gray, silty clay grading into a lighter gray, silty clay at one foot below the surface. With depth, the clay content tended to increase, the color tended to lighten, and the cuttings increased in size and quantity. The initial depth cuttings encountered were found to vary between 0.5 and 1.5 feet below the surface. Of special note is sample point CER-BH-F6; cuttings were reached at 0.5 feet in a light gray, clay matrix which graded to a dark gray, silty clay at 2.5 feet. The presence of peat at this depth was also noted. At three feet, an oily black, fluid sludge-clay was encountered and graded into a white, tan silty clay at six feet. All samples for this area were collected by hand-operated augers. Data for the freshwater cuttings area is shown below.

| Sample ID (CER-BH-F#) | Date/Time | Total Depth Sampled (ft) |
|--------------------------|----------------------|-----------------------------|
| 1 | 05/27/86 - 4:00 p.m. | 3 |
| 2 | 05/27/86 - 4:00 p.m. | 7 |
| 3 | 05/27/86 - 4:20 p.m. | 7 |
| 4 | 05/27/86 - 4:20 p.m. | 4 |
| 5 | 05/28/86 - 7:35 a.m. | 7 |
| 6 | 05/28/86 - 8:30 a.m. | 7 |
| 7 | 05/28/86 - 8:55 a.m. | 4 |
| 8 | 05/28/86 - 7:50 a.m. | 4 |
| 9 | 05/28/86 - 8:20 a.m. | 4 |

The saltwater cuttings area sampling began at 10:00 a.m. on May 28, 1986 and was completed at 3:30 p.m. The ponds are oriented in a northwest-southeast fashion and were numbered Ponds 1, 2, and 3. Pond 1 was the northern most pond, Pond 2 was the center pond, and Pond 3 was the southern most pond. The grid patterns were located in a northwest-southeast, northeast-southwest orientation, and the sample points were approximately 35 feet apart. The ponds are 133 x 230 feet.

The spoil profile of Pond 1 consists of coarse deposits, sand, and cobbles, interbedded with hard, crusty layers of fines partially cemented by evaporite deposits (i.e., anhydrite, halite, etc.). These hard, crusty layers were most notably encountered at 1, 2, 4, 7, and 9 feet below the surface. The east end of Pond 1 has the highest percent solids, as well as the coarsest sediment and grades to lower solids and finer deposits to the west. Seventy-five percent of the pond is covered by 0.20 feet of saline water. The dips on the sides of the pond varies between 30 to 40° and contains approximately ten feet of spoil where the dip levels off. A hand-operated auger was used for sample collection.

The spoil profile of Pond 2 is basically similar to Pond 1 except that the southeast end and the center of the ponds contain the highest solids and coarsest sediment. The coarse component is not as coarse as that in Pond 1 and the percent solids are generally lower. The lowest percent solids are located in the northwest. Eighty percent of the pond is covered by 0.20 feet of saline water. The dips on the sides of the pond varies between 30 to 40°. All samples were collected by a hand-operated auger.

The spoil profile of Pond 3, when compared to the other two ponds, has generally a lower percent solids content and fewer, softer crusty layers. The highest percent solids are located in the northwest. Ninety-five percent of the pond is covered with 0.25 feet of saline water. The dip of the sides varies between 20 to 30° and contains approximately 9.2 feet of spoil where the dip levels off. A hand-operated auger and COLIWASA were used for sample collection.

| POND 1 | | | |
|--------------------------|-----------------------|-----------------------------|------------------------|
| Sample ID (CER-BH-C#) | Date/Time | Total Depth Sampled (ft) | Depth to Spoil (ft) |
| 1 | 05/28/86 - 11:28 a.m. | 9.0 | 0.25 |
| 2 | 05/28/86 - 11:17 a.m. | 8.0 | 0.15 |
| 3 | 05/28/86 - 11:00 a.m. | 8.0 | 0.20 |
| 4 | 05/28/86 - 11:30 a.m. | 10.1 | 0.25 |
| 5 | 05/28/86 - 10:00 a.m. | 8.0 | 0.0 |

| POND 2 | | | |
|--------------------------|-----------------------|-----------------------------|------------------------|
| Sample ID (CER-BH-C#) | Date/Time | Total Depth Sampled (ft) | Depth to Spoil (ft) |
| 6 | 05/28/86 - 12:25 p.m. | 8.0 | 0.1 |
| 7 | 05/28/86 - 1:10 p.m. | 8.0 | 0.3 |
| 8 | 05/28/86 - 12:40 p.m. | 8.0 | 0.0 |
| 9 | 05/28/86 - 1:00 p.m. | 8.0 | 0.2 |
| 10 | 05/28/86 - 12:50 p.m. | 7.0 | 0.2 |

| POND 3 | | | |
|--------------------------|----------------------|-----------------------------|------------------------|
| Sample ID (CER-BH-C#) | Date/Time | Total Depth Sampled (ft) | Depth to Spoil (ft) |
| 11 | 05/28/86 - 2:00 p.m. | 9.5 | 0.3 |
| 12 | 05/28/86 - 2:24 p.m. | 8.0 | 0.2 |
| 13 | 05/28/86 - 2:10 p.m. | 9.5 | 0.3 |
| 14 | 05/28/86 - 2:35 p.m. | 9.5 | 0.3 |
| 15 | 05/28/86 - 2:17 p.m. | 8.0 | 0.2 |

ENVIRONMENTAL PROTECTION AGENCY
Office of Enforcement

CHAIN OF CUSTODY RECORD

| PROJ. NO. | | PROJECT NAME | | NO. OF CONTAINERS | | REMARKS | | | | | |
|-----------------------|------|-----------------------|-------|-------------------|------------------|---------|--|--|--|--|--|
| LER-BH | | Boeing Petro. Service | | | | | | | | | |
| SAMPLERS: (Signature) | | | | | | | | | | | |
| STA. NO. | DATE | TIME | COMP. | GRAB | STATION LOCATION | | | | | | |
| C-1 | 5/28 | 11:28 | | ✓ | | | | | | | |
| C-2 | 5/28 | 11:17 | | ✓ | | | | | | | |
| C-3 | 5/28 | 11:00 | | ✓ | | | | | | | |
| C-4 | 5/28 | 10:30 | | ✓ | | | | | | | |
| C-5 | 5/28 | 10:10 | | ✓ | | | | | | | |
| C-6 | 5/28 | 12:25 | | | | | | | | | |
| C-7 | 5/28 | 11:10 | | | | | | | | | |
| C-8 | 5/28 | 12:40 | | | | | | | | | |
| C-9 | 5/28 | 13:00 | | | | | | | | | |
| C-10 | 5/28 | 12:50 | | | | | | | | | |
| C-11 | 5/28 | 14:00 | | | | | | | | | |
| C-12 | 5/28 | 14:24 | | | | | | | | | |
| C-13 | 5/28 | 14:10 | | | | | | | | | |
| C-14 | 5/28 | 14:35 | | | | | | | | | |
| C-15 | 5/28 | 14:17 | | | | | | | | | |

Pond 1223

| | | | | | |
|------------------------------|--------------|---|------------------------------|-------------|--------------------------|
| Relinquished by: (Signature) | Date / Time | Received by: (Signature) | Relinquished by: (Signature) | Date / Time | Received by: (Signature) |
| | 5-28-86 1515 | | | | |
| Relinquished by: (Signature) | Date / Time | Received by: (Signature) | Relinquished by: (Signature) | Date / Time | Received by: (Signature) |
| | 5-29 11:00 | | | | |
| Relinquished by: (Signature) | Date / Time | Received for Laboratory by: (Signature) | Date / Time | Remarks | |
| | | | | | |

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

6 / SAMPLING - Chain of Custody

3-0605

Figure 3. Example of chain-of-custody record.

ENVIRONMENTAL PROTECTION AGENCY
Office of Enforcement

CHAIN OF CUSTODY RECORD

| PROJ. NO. | | PROJECT NAME | | | | NO. OF CON- TAINERS | | | | | | | REMARKS |
|------------------------------|------|--------------|-------------|------|---|------------------------------|------------------------------|--|---------|-------------|--|--------------------------|---------|
| SAMPLERS: (Signature) | | | | | | | | | | | | | |
| STA. NO. | DATE | TIME | COMP. | GRAB | STATION LOCATION | | | | | | | | |
| F-1 | 5/27 | 16:00 | | / | Fresh H ₂ O POW | 1 | | | | | | | |
| F-2 | 5/27 | 16:00 | | / | | 1 | | | | | | | |
| F-3 | 5/27 | 16:20 | | / | | 1 | | | | | | | |
| F-4 | 5/27 | 16:26 | | / | | 1 | | | | | | | |
| F-5 | 5/28 | 7:35 | | / | | 1 | | | | | | | |
| F-6 | 5/28 | 8:30 | | / | | 1 | | | | | | | |
| F-7 | 5/28 | 8:55 | | / | | 1 | | | | | | | |
| F-8 | 5/28 | 7:50 | | / | | 1 | | | | | | | |
| F-9 | 5/28 | 8:20 | | / | | 1 | | | | | | | |
| Relinquished by: (Signature) | | | Date / Time | | Received by: (Signature) | | Relinquished by: (Signature) | | | Date / Time | | Received by: (Signature) | |
| Relinquished by: (Signature) | | | Date / Time | | Received by: (Signature) | | Relinquished by: (Signature) | | | Date / Time | | Received by: (Signature) | |
| Relinquished by: (Signature) | | | Date / Time | | Received for Laboratory by: (Signature) | | Date / Time | | Remarks | | | | |

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

6 / SAMPLING - Chain of Custody

3-0605

Figure 3. Example of chain-of-custody record.

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC.
2445 Florida Ave., Kenner, Louisiana 70062
(504) 469-0333

LABORATORY REPORT

CLIENT: Boeing Petroleum Services

Sample Description: 24 EP Leachate
Laboratory Number: 860624

| | | | |
|-----------------|-------------|-----------------|-----------|
| Sampling Date: | 05/27-28/86 | Time Sampled: | 0800-1700 |
| Date Received: | 05/29/86 | Time Received: | 0800 Hrs. |
| Date Analyzed: | 06/05/86 | Time Analyzed: | 1508 Hrs. |
| Date Completed: | 07/01/86 | Time Completed: | 1520 Hrs. |

Analyses Requested: EP Metals and EP Organics

RESULTS

| | F1 | F2 | F3 | F4 | F5 | F6 |
|-----------------|--------|--------|--------|--------|--------|--------|
| Arsenic (mg/l) | 0.002 | <0.002 | <0.002 | <0.002 | <0.002 | 0.003 |
| Barium (mg/l) | 0.2 | 0.2 | 1.8 | 0.1 | 0.87 | <0.1 |
| Cadmium (mg/l) | <0.005 | <0.005 | 0.006 | 0.005 | <0.005 | 0.021 |
| Chromium (mg/l) | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Lead (mg/l) | <0.05 | <0.05 | 0.09 | 0.07 | 0.24 | <0.05 |
| Mercury (mg/l) | 0.003 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Selenium (mg/l) | <0.002 | <0.002 | 0.011 | 0.008 | 0.007 | 0.021 |
| Silver (mg/l) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | 0.02 |

| | F7 | F8 | F9 | C1 | C2 | C3 |
|-----------------|--------|--------|--------|--------|-------|-------|
| Arsenic (mg/l) | <0.002 | <0.002 | <0.002 | 0.024 | 0.005 | 0.007 |
| Barium (mg/l) | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Cadmium (mg/l) | <0.005 | <0.005 | <0.005 | 0.032 | 0.036 | 0.029 |
| Chromium (mg/l) | <0.005 | <0.005 | <0.005 | 0.07 | 0.07 | 0.07 |
| Lead (mg/l) | <0.05 | <0.05 | <0.05 | 1.24 | 1.09 | 1.18 |
| Mercury (mg/l) | <0.002 | <0.002 | <0.002 | 0.0027 | 0.003 | 0.003 |
| Selenium (mg/l) | 0.008 | 0.004 | 0.002 | 0.023 | 0.031 | 0.028 |
| Silver (mg/l) | <0.01 | <0.01 | <0.01 | 0.09 | 0.05 | 0.05 |

-continued-



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

RESULTS

| | C4 | C5 | C6 | C7 | C8 | C9 |
|-----------------|--------|--------|--------|--------|-------|--------|
| Arsenic (mg/l) | 0.019 | 0.034 | 0.057 | 0.034 | 0.046 | 0.009 |
| Barium (mg/l) | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Cadmium (mg/l) | <0.005 | <0.005 | 0.010 | 0.025 | 0.011 | 0.013 |
| Chromium (mg/l) | 0.05 | 0.05 | 0.08 | 0.08 | 0.05 | 0.05 |
| Lead (mg/l) | 1.10 | 1.15 | 1.63 | 3.50 | 1.41 | 0.93 |
| Mercury (mg/l) | 0.003 | <0.002 | <0.002 | <0.002 | 0.002 | <0.002 |
| Selenium (mg/l) | 0.013 | 0.012 | 0.011 | 0.009 | 0.007 | 0.012 |
| Silver (mg/l) | 0.084 | 0.052 | 0.036 | 0.052 | 0.049 | 0.041 |

| | C10 | C11 | C12 | C13 | C14 | C15 |
|-----------------|--------|--------|--------|--------|--------|--------|
| Arsenic (mg/l) | 0.062 | 0.027 | 0.04 | 0.03 | 0.063 | 0.038 |
| Barium (mg/l) | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Cadmium (mg/l) | 0.025 | 0.039 | 0.026 | 0.028 | 0.035 | 0.008 |
| Chromium (mg/l) | 0.07 | 0.11 | 0.026 | 0.09 | 0.07 | 0.05 |
| Lead (mg/l) | 0.62 | 0.88 | 1.43 | 0.70 | 0.63 | 0.47 |
| Mercury (mg/l) | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 | <0.002 |
| Selenium (mg/l) | 0.016 | 0.010 | 0.010 | 0.006 | 0.012 | 0.013 |
| Silver (mg/l) | 0.038 | 0.044 | 0.036 | 0.024 | 0.040 | 0.030 |

PESTICIDES

| ENDRIN | | | LINDANE | | |
|--------|--------------------------------|--|---------|--------------------------------|--|
| | <u>Concentration</u> (µg/l) | <u>Detection</u> <u>Limit</u> (µg/l) | | <u>Concentration</u> (µg/l) | <u>Detection</u> <u>Limit</u> (µg/l) |
| F1 | BDL | 1 | | BDL | 1 |
| F2 | BDL | 1 | | BDL | 1 |
| F3 | BDL | 1 | | BDL | 1 |
| F4 | BDL | 1 | | BDL | 1 |
| F5 | BDL | 1 | | BDL | 1 |
| F6 | BDL | 1 | | BDL | 1 |
| F7 | BDL | 1 | | BDL | 1 |
| F8 | BDL | 1 | | BDL | 1 |
| F9 | BDL | 1 | | BDL | 1 |
| C1 | BDL | 1 | | BDL | 1 |
| C2 | BDL | 1 | | BDL | 1 |
| C3 | BDL | 1 | | BDL | 1 |
| C4 | BDL | 1 | | BDL | 1 |
| C5 | BDL | 1 | | BDL | 1 |
| C6 | BDL | 1 | | BDL | 1 |
| C7 | BDL | 1 | | BDL | 1 |

-continued-



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

| ENDRIN | | | LINDANE | | |
|--------|---|---|---|---|--|
| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection Limit</u> ($\mu\text{g/l}$) | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection Limit</u> ($\mu\text{g/l}$) | |
| C8 | BDL | 1 | BDL | 1 | |
| C9 | BDL | 1 | BDL | 1 | |
| C10 | BDL | 1 | BDL | 1 | |
| C11 | BDL | 1 | BDL | 1 | |
| C12 | BDL | 1 | BDL | 1 | |
| C13 | BDL | 1 | BDL | 1 | |
| C14 | BDL | 1 | BDL | 1 | |
| C15 | BDL | 1 | BDL | 1 | |

| METHOXYCHLOR | | | TOXAPHENE | | |
|--------------|---|---|---|---|--|
| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection Limit</u> ($\mu\text{g/l}$) | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection Limit</u> ($\mu\text{g/l}$) | |
| F1 | BDL | 1 | BDL | 10 | |
| F2 | BDL | 1 | BDL | 10 | |
| F3 | BDL | 1 | BDL | 10 | |
| F4 | BDL | 1 | BDL | 10 | |
| F5 | BDL | 1 | BDL | 10 | |
| F6 | BDL | 1 | BDL | 10 | |
| F7 | BDL | 1 | BDL | 10 | |
| F8 | BDL | 1 | BDL | 10 | |
| F9 | BDL | 1 | BDL | 10 | |
| C1 | BDL | 1 | BDL | 10 | |
| C2 | BDL | 1 | BDL | 10 | |
| C3 | BDL | 1 | BDL | 10 | |
| C4 | BDL | 1 | BDL | 10 | |
| C5 | BDL | 1 | BDL | 10 | |
| C6 | BDL | 1 | BDL | 10 | |
| C7 | BDL | 1 | BDL | 10 | |
| C8 | BDL | 1 | BDL | 10 | |
| C9 | BDL | 1 | BDL | 10 | |
| C10 | BDL | 1 | BDL | 10 | |
| C11 | BDL | 1 | BDL | 10 | |
| C12 | BDL | 1 | BDL | 10 | |
| C13 | BDL | 1 | BDL | 10 | |
| C14 | BDL | 1 | BDL | 10 | |
| C15 | BDL | 1 | BDL | 10 | |

-continued-

HERBICIDES

| | 2,4-D | | SILVEX | |
|-----|---|---|---|---|
| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection</u> <u>Limit</u> ($\mu\text{g/l}$) | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection</u> <u>Limit</u> ($\mu\text{g/l}$) |
| F1 | BDL | 2 | BDL | 2 |
| F2 | BDL | 2 | BDL | 2 |
| F3 | BDL | 2 | BDL | 2 |
| F4 | BDL | 2 | BDL | 2 |
| F5 | BDL | 2 | BDL | 2 |
| F6 | BDL | 2 | BDL | 2 |
| F7 | BDL | 2 | BDL | 2 |
| F8 | BDL | 2 | BDL | 2 |
| F9 | BDL | 2 | BDL | 2 |
| C1 | BDL | 2 | BDL | 2 |
| C2 | BDL | 2 | BDL | 2 |
| C3 | BDL | 2 | BDL | 2 |
| C4 | BDL | 2 | BDL | 2 |
| C5 | BDL | 2 | BDL | 2 |
| C6 | BDL | 2 | BDL | 2 |
| C7 | BDL | 2 | BDL | 2 |
| C8 | BDL | 2 | BDL | 2 |
| C9 | BDL | 2 | BDL | 2 |
| C10 | BDL | 2 | BDL | 2 |
| C11 | BDL | 2 | BDL | 2 |
| C12 | BDL | 2 | BDL | 2 |
| C13 | BDL | 2 | BDL | 2 |
| C14 | BDL | 2 | BDL | 2 |
| C15 | BDL | 2 | BDL | 2 |

BDL: Below Detection Limit

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METHODS


Analytical methods according to Standard Methods for the Examination of Water and Wastewater. American Public Health Association, 15th Edition, 1980.

| | |
|----------|-----------------------|
| Arsenic | Method 304, Page 166 |
| Barium | Method 303C, Page 157 |
| Cadmium | Method 303B, Page 156 |
| Chromium | Method 303A, Page 152 |
| Lead | Method 303A, Page 152 |
| Mercury | Method 320, Page 217 |
| Selenium | Method 304, Page 166 |
| Silver | Method 303A, Page 152 |

Test Method for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Second Edition Revised, USEPA, April 1984.

Pesticides : Method 8080

Herbicides : Method 8150

Analyzed by: 

Date: 7/2/88

Approved By: 

Date: 7/1/88

Thomas E. Orr - QA/QC Manager

EIRA

ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

ATTACHMENT 2

EP TOXICITY
Cr⁺⁶

| Sample ID | Cr ⁺⁶ (mg/l) |
|------------|----------------------------|
| CER-BH-F1 | <0.02 |
| CER-BH-F2 | <0.02 |
| CER-BH-F3 | <0.02 |
| CER-BH-F4 | <0.02 |
| CER-BH-F5 | <0.02 |
| CER-BH-F6 | <0.02 |
| CER-BH-F7 | <0.02 |
| CER-BH-F8 | <0.02 |
| CER-BH-F9 | <0.02 |
| CER-BH-C1 | 0.04 |
| CER-BH-C2 | 0.04 |
| CER-BH-C3 | 0.03 |
| CER-BH-C4 | 0.04 |
| CER-BH-C5 | 0.04 |
| CER-BH-C6 | 0.04 |
| CER-BH-C7 | 0.02 |
| CER-BH-C8 | <0.02 |
| CER-BH-C9 | 0.02 |
| CER-BH-C10 | 0.02 |
| CER-BH-C11 | 0.02 |
| CER-BH-C12 | <0.02 |
| CER-BH-C13 | <0.02 |
| CER-BH-C14 | 0.03 |
| CER-BH-C15 | <0.02 |

LABORATORY REPORT FOR BIG HILL WELLS
(INORGANICS: ALL WELLS; ORGANICS: WELL 101A)

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES, INC.
161 James Drive West, Suite 100
St. Rose, Louisiana 70087
(504) 469-0333

LABORATORY REPORT

Prepared for: Boeing Petroleum Services

Sample Description: 28 Wells

Laboratory Number: 870159

Job Number: Not Supplied

Date Received: 01/12/87

Sampled By: E.I.R.A

Analyses Requested: See Attached

RESULTS

* RESULTS ARE ATTACHED *



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

101-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-----------------------------|-----------------------------|------------------------------|
| Antimony | 6300 | 300 |
| Arsenic | 70 | 5 |
| Barium | 5250 | 250 |
| Beryllium | 63 | 13 |
| Cadmium | 998 | 13 |
| Chromium | 1700 | 125 |
| Copper | 10700 | 50 |
| Lead | 85300 | 630 |
| Mercury | 1.2 | 0.8 |
| Nickel | 4060 | 100 |
| Selenium | 248 | 5 |
| Silver | 750 | 30 |
| Thallium | 6800 | 300 |
| Zinc | 92900 | 500 |
| Total Cyanide ⁺⁶ | 880 | 20 |
| Chromium ⁺⁶ | 50 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

101-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-----------------------------|-----------------------------|------------------------------|
| Antimony | 5400 | 200 |
| Arsenic | 20 | 5 |
| Barium | 30000 | 400 |
| Beryllium | 52 | 10 |
| Cadmium | 1000 | 10 |
| Chromium | 2760 | 100 |
| Copper | 14000 | 80 |
| Lead | 51900 | 50 |
| Mercury | 6 | 0.8 |
| Nickel | 4320 | 80 |
| Selenium | 388 | 25 |
| Silver | 680 | 20 |
| Thallium | 6200 | 200 |
| Zinc | 101000 | 500 |
| Total Cyanide ⁺⁶ | 5810 | 10 |
| Chromium ⁺⁶ | 70 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

102-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 4400 | 200 |
| Arsenic | BDL | 4 |
| Barium | 400 | 200 |
| Beryllium | 54 | 10 |
| Cadmium | 910 | 10 |
| Chromium | 240 | 100 |
| Copper | 680 | 40 |

| | | |
|-----------------------------|------|------------------------------|
| Lead | 3560 | 100 |
| Mercury | 0.6 | 0.6 |
| Nickel | 3560 | 80 |
| Selenium | 32 | 4 |
| Silver | 640 | 20 |
| Thallium | 5600 | 200 |
| Zinc | 1180 | 10 |
| Total Cyanide ⁺⁶ | 80 | 10 |
| Chromium | 80 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

102-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-----------------------------|-----------------------------|------------------------------|
| Antimony | 4800 | 200 |
| Arsenic | BDL | 4 |
| Barium | 600 | 200 |
| Beryllium | 78 | 10 |
| Cadmium | 886 | 10 |
| Chromium | 220 | 100 |
| Copper | 760 | 40 |
| Lead | 3200 | 100 |
| Mercury | 0.6 | 0.6 |
| Nickel | 3400 | 80 |
| Selenium | 46 | 4 |
| Silver | 640 | 20 |
| Thallium | 5600 | 200 |
| Zinc | 910 | 10 |
| Total Cyanide ⁺⁶ | 40 | 10 |
| Chromium | 90 | 100 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

103-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-----------------------------|-----------------------------|------------------------------|
| Antimony | 6500 | 300 |
| Arsenic | 78 | 6 |
| Barium | 21500 | 250 |
| Beryllium | 100 | 13 |
| Cadmium | 1170 | 13 |
| Chromium | 2930 | 130 |
| Copper | 48400 | 400 |
| Lead | 265000 | 1250 |
| Mercury | 6.4 | 0.8 |
| Nickel | 5830 | 100 |
| Selenium | 282 | 6 |
| Silver | 850 | 30 |
| Thallium | 6500 | 300 |
| Zinc | 467000 | 6300 |
| Total Cyanide ⁺⁶ | 45500 | 10 |
| Chromium | 60 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

103-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 5200 | 200 |
| Arsenic | BDL | 4 |
| Barium | 40000 | 400 |
| Beryllium | 70 | 10 |
| Cadmium | 900 | 101 |
| Chromium | 1320 | 100 |
| Copper | 1160 | 40 |
| Lead | 5480 | 100 |
| Mercury | 1.8 | 0.6 |
| Nickel | 3540 | 80 |
| Selenium | 6 | 4 |
| Silver | 640 | 20 |
| Thallium | 5200 | 200 |
| Zinc | 8620 | 100 |
| Total Cyanide | 10400 | 10 |
| Chromium ⁺⁶ | 50 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

104-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 2600 | 200 |
| Arsenic | BDL | 2 |
| Barium | 32400 | 400 |
| Beryllium | 100 | 10 |
| Cadmium | 940 | 10 |
| Chromium | 1060 | 100 |
| Copper | 2540 | 40 |
| Lead | 20000 | 200 |
| Mercury | 1.6 | 0.8 |
| Nickel | 3300 | 80 |
| Selenium | 136 | 8 |
| Silver | 400 | 20 |
| Thallium | 6400 | 200 |
| Zinc | 24300 | 200 |
| Total Cyanide | 4000 | 10 |
| Chromium ⁺⁶ | 40 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

104-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 2200 | 200 |
| Arsenic | 56 | 4 |
| Barium | 600 | 200 |
| Beryllium | 780 | 10 |
| Cadmium | 860 | 10 |
| Chromium | 220 | 100 |
| Copper | 300 | 20 |

| | | |
|------------------------|------|------------------------------|
| Lead | 4400 | 200 |
| Mercury | 0.8 | 0.5 |
| Nickel | 2600 | 80 |
| Selenium | BDL | 2 |
| Silver | 360 | 20 |
| Thallium | 5000 | 200 |
| Zinc | 930 | 10 |
| Total Cyanide | 20 | 10 |
| Chromium ⁺⁶ | 70 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

105-A 01/12 COMPOSITE

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 6000 | 500 |
| Arsenic | 5 | 2 |
| Barium | 500 | 500 |
| Beryllium | 50 | 25 |
| Cadmium | 534 | 5 |
| Chromium | 160 | 50 |
| Copper | 340 | 20 |
| Lead | 2900 | 100 |
| Mercury | 3.2 | 0.2 |
| Nickel | 3300 | 200 |
| Selenium | 90 | 2 |
| Silver | 200 | 10 |
| Thallium | 2500 | 500 |
| Zinc | 910 | 25 |
| Total Cyanide | 220 | 10 |
| Chromium ⁺⁶ | 70 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

105-B 12/13 COMPOSITE

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 5000 | 500 |
| Arsenic | BDL | 2 |
| Barium | 500 | 500 |
| Beryllium | 450 | 25 |
| Cadmium | 401 | 5 |
| Chromium | 200 | 20 |
| Copper | 350 | 20 |
| Lead | 2900 | 100 |
| Mercury | 3.6 | 0.2 |
| Nickel | 3300 | 200 |
| Selenium | 46 | 2 |
| Silver | 180 | 10 |
| Thallium | 2500 | 500 |
| Zinc | 3150 | 25 |
| Total Cyanide | 260 | 10 |
| Chromium ⁺⁶ | 60 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

106-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 5400 | 400 |
| Arsenic | BDL | 6 |
| Barium | 800 | 200 |
| Beryllium | 84 | 10 |
| Cadmium | 916 | 10 |
| Chromium | 220 | 100 |
| Copper | 560 | 40 |
| Lead | 4720 | 100 |
| Mercury | 1.5 | 0.6 |
| Nickel | 3880 | 80 |
| Selenium | 12 | 6 |
| Silver | 380 | 20 |
| Thallium | 4800 | 200 |
| Zinc | 494 | 5 |
| Total Cyanide | 40 | 10 |
| Chromium ⁺⁶ | 60 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

106-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 4600 | 400 |
| Arsenic | BDL | 6 |
| Barium | 3200 | 200 |
| Beryllium | 78 | 10 |
| Cadmium | 836 | 10.9 |
| Chromium | 300 | 100 |
| Copper | 2180 | 40 |
| Lead | 11000 | 100 |
| Mercury | 3 | 0.6 |
| Nickel | 3420 | 80 |
| Selenium | 63 | 6 |
| Silver | 360 | 200 |
| Thallium | 4200 | 20 |
| Zinc | 7990 | 50 |
| Total Cyanide | 230 | 10 |
| Chromium ⁺⁶ | 80 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

107-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 3500 | 1000 |
| Arsenic | 580 | 40 |
| Barium | 5300 | 100 |
| Beryllium | 52 | 10 |
| Cadmium | 345 | 25 |
| Chromium | 400 | 250 |
| Copper | 680 | 40 |

| | | |
|------------------------|------|------------------------------|
| Lead | 5600 | 200 |
| Mercury | 2.6 | 0.2 |
| Nickel | 2300 | 200 |
| Selenium | 46 | 4 |
| Silver | 260 | 20 |
| Thallium | 3300 | 100 |
| Zinc | 2380 | 25 |
| Total Cyanide | 230 | 10 |
| Chromium ⁺⁶ | 70 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

107-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 6200 | 400 |
| Arsenic | BDL | 6 |
| Barium | 2800 | 200 |
| Beryllium | 88 | 10 |
| Cadmium | 908 | 10 |
| Chromium | 280 | 100 |
| Copper | 620 | 40 |
| Lead | 5360 | 100 |
| Mercury | 2.4 | 0.6 |
| Nickel | 3900 | 4 |
| Selenium | 33 | 6 |
| Silver | 360 | 20 |
| Thallium | 5000 | 200 |
| Zinc | 1540 | 10 |
| Total Cyanide | 40 | 40 |
| Chromium ⁺⁶ | 90 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

108-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 4000 | 1000 |
| Arsenic | 48 | 4 |
| Barium | 3200 | 100 |
| Beryllium | 38 | 10 |
| Cadmium | 235 | 25 |
| Chromium | 100 | 250 |
| Copper | 820 | 40 |
| Lead | 3200 | 200 |
| Mercury | 2.6 | 0.2 |
| Nickel | 1600 | 200 |
| Selenium | 44 | 4 |
| Silver | 200 | 20 |
| Thallium | 2400 | 100 |
| Zinc | 2990 | 25 |
| Total Cyanide | 230 | 10 |
| Chromium ⁺⁶ | 50 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

108-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 1300 | 200 |
| Arsenic | BDL | 2 |
| Barium | 1500 | 100 |
| Beryllium | 10 | 5 |
| Cadmium | 86 | 5 |
| Chromium | 180 | 50 |
| Copper | 160 | 20 |
| Lead | 400 | 100 |
| Mercury | 2.8 | 0.2 |
| Nickel | 400 | 40 |
| Selenium | 98 | 4 |
| Silver | 70 | 10 |
| Thallium | 400 | 100 |
| Zinc | 654 | 5 |
| Total Cyanide | 30 | 10 |
| Chromium ⁺⁶ | 80 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

109-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 4800 | 100 |
| Arsenic | 7 | 2 |
| Barium | 7700 | 100 |
| Beryllium | 247 | 5 |
| Cadmium | 430 | 10 |
| Chromium | 2900 | 50 |
| Copper | 1060 | 20 |
| Lead | 6380 | 50 |
| Mercury | 3 | 0.2 |
| Nickel | 2590 | 40 |
| Selenium | 64 | 2 |
| Silver | 220 | 10 |
| Thallium | 2700 | 100 |
| Zinc | 5860 | 50 |
| Total Cyanide | 20 | 10 |
| Chromium ⁺⁶ | 60 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

109-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 1800 | 200 |
| Arsenic | BDL | 2 |
| Barium | 1700 | 100 |
| Beryllium | 16 | 5 |
| Cadmium | 116 | 5 |
| Chromium | 120 | 5 |
| Copper | 350 | 20 |

| | | |
|------------------------|------|------------------------------|
| Lead | 900 | 100 |
| Mercury | 3.2 | 0.2 |
| Nickel | 610 | 40 |
| Selenium | 46 | 4 |
| Silver | 90 | 10 |
| Thallium | 600 | 100 |
| Zinc | 1380 | 10 |
| Total Cyanide | 40 | 10 |
| Chromium ⁺⁶ | 70 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

110-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 700 | 100 |
| Arsenic | 8 | 2 |
| Barium | 1500 | 500 |
| Beryllium | 9 | 5 |
| Cadmium | 49 | 5 |
| Chromium | 450 | 50 |
| Copper | 5740 | 40 |
| Lead | 24000 | 500 |
| Mercury | 6.2 | 0.2 |
| Nickel | 1040 | 4 |
| Selenium | 34 | 4 |
| Silver | 40 | 10 |
| Thallium | 300 | 100 |
| Zinc | 115000 | 2500 |
| Total Cyanide | 1990 | 10 |
| Chromium ⁺⁶ | 20 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

110-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 3500 | 100 |
| Arsenic | 3 | 2 |
| Barium | 1000 | 500 |
| Beryllium | 39 | 5 |
| Cadmium | 411 | 5 |
| Chromium | 170 | 50 |
| Copper | 330 | 20 |
| Lead | 2500 | 100 |
| Mercury | 2.4 | 0.2 |
| Nickel | 2670 | 40 |
| Selenium | 45 | 10 |
| Silver | 210 | 10 |
| Thallium | 3800 | 100 |
| Zinc | 3130 | 25 |
| Total Cyanide | 20 | 100 |
| Chromium ⁺⁶ | 90 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

111-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 12800 | 300 |
| Arsenic | 320 | 10 |
| Barium | 7000 | 300 |
| Beryllium | 95 | 13 |
| Cadmium | 900 | 13 |
| Chromium | 3580 | 130 |
| Copper | 111000 | 50 |
| Lead | 115000 | 2500 |
| Mercury | 4800 | 1.2 |
| Nickel | 5780 | 100 |
| Selenium | 400 | 40 |
| Silver | 400 | 30 |
| Thallium | 7300 | 300 |
| Zinc | 169000 | 1300 |
| Total Cyanide | 200 | 20 |
| Chromium ⁺⁶ | 100 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

111-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 6600 | 200 |
| Arsenic | BDL | 4 |
| Barium | 1200 | 200 |
| Beryllium | 54 | 10 |
| Cadmium | 852 | 10 |
| Chromium | 120 | 100 |
| Copper | 800 | 40 |
| Lead | 3200 | 200 |
| Mercury | 3.6 | 0.8 |
| Nickel | 4740 | 30 |
| Selenium | 60 | 4 |
| Silver | 280 | 20 |
| Thallium | 5600 | 300 |
| Zinc | 442 | 10 |
| Total Cyanide | 90 | 10 |
| Chromium ⁺⁶ | 80 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

112-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 3300 | 200 |
| Arsenic | 480 | 4 |
| Barium | 900 | 200 |
| Beryllium | 33 | 8 |
| Cadmium | 705 | 8 |
| Chromium | 210 | 80 |

| | | |
|------------------------|------|------------------------------|
| Copper | 750 | 30 |
| Lead | 4310 | 8 |
| Mercury | 3.6 | 0.8 |
| Nickel | 2970 | 60 |
| Selenium | 62 | 4 |
| Silver | 620 | 20 |
| Thallium | 5100 | 200 |
| Zinc | 567 | 8 |
| Total Cyanide | 170 | 10 |
| Chromium ⁺⁶ | 70 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

112-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 4600 | 200 |
| Arsenic | BDL | 4 |
| Barium | 1200 | 200 |
| Beryllium | 98 | 10 |
| Cadmium | 1250 | 10 |
| Chromium | 300 | 100 |
| Copper | 1060 | 40 |
| Lead | 4380 | 100 |
| Mercury | 5.2 | 0.8 |
| Nickel | 4720 | 80 |
| Selenium | 36 | 4 |
| Silver | 920 | 20 |
| Thallium | 7200 | 200 |
| Zinc | 1420 | 10 |
| Total Cyanide | 20 | 10 |
| Chromium ⁺⁶ | 50 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

113-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 6800 | 400 |
| Arsenic | BDL | 6 |
| Barium | 400 | 200 |
| Beryllium | 76 | 10 |
| Cadmium | 844 | 10 |
| Chromium | 180 | 100 |
| Copper | 480 | 40 |
| Lead | 3860 | 100 |
| Mercury | 3.3 | 0.6 |
| Nickel | 3420 | 80 |
| Selenium | 21 | 6 |
| Silver | 400 | 20 |
| Thallium | 3800 | 200 |
| Zinc | 1240 | 10 |
| Total Cyanide | 300 | 20 |
| Chromium ⁺⁶ | 60 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

113-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 6000 | 400 |
| Arsenic | BDL | 6 |
| Barium | 3000 | 200 |
| Beryllium | 86 | 10 |
| Cadmium | 930 | 10 |
| Chromium | 360 | 100 |
| Copper | 1320 | 40 |
| Lead | 30000 | 500 |
| Mercury | 2.4 | 0.6 |
| Nickel | 3900 | 80 |
| Selenium | 234 | 6 |
| Silver | 380 | 20 |
| Thallium | 4600 | 200 |
| Zinc | 36100 | 200 |
| Total Cyanide | 10400 | 10 |
| Chromium ⁺⁶ | 80 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

114-A BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|------------------------|-----------------------------|------------------------------|
| Antimony | 5000 | 200 |
| Arsenic | BDL | 4 |
| Barium | 1200 | 200 |
| Beryllium | 68 | 10 |
| Cadmium | 592 | 10 |
| Chromium | 160 | 100 |
| Copper | 870 | 40 |
| Lead | 2600 | 200 |
| Mercury | 21 | 0.6 |
| Nickel | 2920 | 80 |
| Selenium | 56 | 4 |
| Silver | 280 | 20 |
| Thallium | 4600 | 200 |
| Zinc | 492 | 10 |
| Total Cyanide | 480000 | 20 |
| Chromium ⁺⁶ | 70 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

114-B BIG HILL

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 6400 | 200 |
| Arsenic | 196 | 8 |
| Barium | 10600 | 200 |
| Beryllium | 56 | 10 |
| Cadmium | 808 | 10 |
| Chromium | 1860 | 10 |

| | | |
|------------------------|--------|------------------------------|
| Copper | 23000 | 200 |
| Lead | 210000 | 2000 |
| Mercury | 11.2 | 0.8 |
| Nickel | 5720 | 80 |
| Selenium | 400 | 20 |
| Silver | 380 | 20 |
| Thallium | 5400 | 200 |
| Zinc | 189000 | 1000 |
| Total Cyanide | 160 | 10 |
| Chromium ⁺⁶ | 60 | 10 |
| Asbestos | BDL | (Fibers/l) 6.9×10^5 |

QUALITY CONTROL LAB BLANK

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 100 | 100 |
| Arsenic | BDL | 2 |
| Barium | BDL | 100 |
| Beryllium | BDL | 5 |
| Cadmium | BDL | 5 |
| Chromium | BDL | 50 |
| Copper | BDL | 20 |
| Lead | BDL | 50 |
| Mercury | 0.4 | 0.2 |
| Nickel | BDL | 40 |
| Selenium | BDL | 2 |
| Silver | BDL | 10 |
| Thallium | BDL | 10 |
| Zinc | 31 | 5 |

QUALITY CONTROL LAB BLANK

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 100 | 100 |
| Arsenic | BDL | 2 |
| Barium | BDL | 100 |
| Beryllium | BDL | 5 |
| Cadmium | 15 | 5 |
| Chromium | BDL | 50 |
| Copper | BDL | 20 |
| Lead | BDL | 50 |
| Mercury | 0.4 | 0.2 |
| Nickel | BDL | 40 |
| Selenium | BDL | 2 |
| Silver | BDL | 10 |
| Thallium | BDL | 100 |
| Zinc | 31 | 5 |

QUALITY CONTROL LAB BLANK

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | BDL | 200 |
| Arsenic | BDL | 2 |
| Barium | BDL | 100 |
| Beryllium | BDL | 5 |
| Cadmium | 7 | 5 |
| Chromium | BDL | 50 |
| Copper | BDL | 20 |
| Lead | BDL | 100 |
| Mercury | 0.6 | 0.2 |
| Nickel | 70 | 40 |
| Selenium | BDL | 2 |
| Silver | BDL | 10 |
| Thallium | BDL | 100 |
| Zinc | 13 | 5 |

QUALITY CONTROL LAB BLANK

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | BDL | 200 |
| Arsenic | 2 | 2 |
| Barium | BDL | 100 |
| Beryllium | BDL | 5 |
| Cadmium | 9 | 5 |
| Chromium | BDL | 50 |
| Copper | BDL | 20 |
| Lead | BDL | 100 |
| Mercury | 0.6 | 0.2 |
| Nickel | 70 | 40 |
| Selenium | BDL | 2 |
| Silver | BDL | 10 |
| Thallium | BDL | 100 |
| Zinc | 13 | 5 |

QUALITY CONTROL LAB BLANK

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | BDL | 100 |
| Arsenic | BDL | 2 |
| Barium | BDL | 100 |
| Beryllium | BDL | 5 |
| Cadmium | BDL | 10 |
| Chromium | BDL | 50 |
| Copper | BDL | 20 |
| Lead | BDL | 50 |
| Mercury | BDL | 0.2 |
| Nickel | BDL | 40 |
| Selenium | 2 | 2 |

| | | |
|----------|-----|-----|
| Silver | BDL | 10 |
| Thallium | BDL | 100 |
| Zinc | 157 | 5 |

QUALITY CONTROL LAB BLANK

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | BDL | 100 |
| Arsenic | BDL | 2 |
| Barium | 100 | 100 |
| Beryllium | BDL | 5 |
| Cadmium | 11 | 5 |
| Chromium | BDL | 50 |
| Copper | BDL | 20 |
| Lead | BDL | 100 |
| Mercury | 0.2 | 0.2 |
| Nickel | BDL | 40 |
| Selenium | BDL | 2 |
| Silver | BDL | 10 |
| Thallium | BDL | 100 |
| Zinc | 23 | 5 |

QUALITY CONTROL LAB BLANK

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 100 | 100 |
| Arsenic | BDL | 2 |
| Barium | 100 | 100 |
| Beryllium | BDL | 5 |
| Cadmium | 15 | 5 |
| Chromium | BDL | 50 |
| Copper | BDL | 20 |
| Lead | BDL | 50 |
| Mercury | 0.4 | 0.2 |
| Nickel | BDL | 40 |
| Selenium | BDL | 2 |
| Silver | BDL | 10 |
| Thallium | BDL | 100 |
| Zinc | 20 | 5 |

QUALITY CONTROL LAB BLANK

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 100 | 100 |
| Arsenic | BDL | 2 |
| Barium | 100 | 100 |
| Beryllium | BDL | 5 |
| Cadmium | BDL | 5 |
| Chromium | BDL | 50 |
| Copper | BDL | 20 |
| Lead | BDL | 100 |

| | | |
|----------|-----|-----|
| Mercury | 0.4 | 0.2 |
| Nickel | 40 | 40 |
| Selenium | BDL | 2 |
| Silver | BDL | 2 |
| Thallium | BDL | 100 |
| Zinc | 20 | 5 |

QUALITY CONTROL LAB BLANK

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 100 | 100 |
| Arsenic | BDL | 2 |
| Barium | 100 | 100 |
| Beryllium | BDL | 5 |
| Cadmium | 9 | 5 |
| Chromium | BDL | 50 |
| Copper | BDL | 20 |
| Lead | BDL | 10 |
| Mercury | 0.3 | 0.2 |
| Nickel | BDL | 40 |
| Selenium | BDL | 2 |
| Silver | BDL | 10 |
| Thallium | BDL | 100 |
| Zinc | 20 | 5 |

QUALITY CONTROL LAB BLANK

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | BDL | 200 |
| Arsenic | BDL | 2 |
| Barium | BDL | 100 |
| Beryllium | BDL | 5 |
| Cadmium | BDL | 5 |
| Chromium | BDL | 50 |
| Copper | BDL | 20 |
| Lead | BDL | 50 |
| Mercury | BDL | 0.2 |
| Nickel | BDL | 4 |
| Selenium | BDL | 2 |
| Silver | BDL | 10 |
| Thallium | BDL | 100 |
| Zinc | BDL | 5 |

QUALITY CONTROL LAB BLANK

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | BDL | 200 |
| Arsenic | BDL | 2 |
| Barium | BDL | 100 |
| Beryllium | BDL | 5 |
| Cadmium | BDL | 5 |

| | | |
|----------|-----|-----|
| Chromium | BDL | 50 |
| Copper | BDL | 20 |
| Lead | BDL | 50 |
| Mercury | BDL | 0.2 |
| Nickel | BDL | 40 |
| Selenium | BDL | 2 |
| Silver | BDL | 10 |
| Thallium | BDL | 100 |
| Zinc | 21 | 5 |

QUALITY CONTROL LAB BLANK

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | BDL | 200 |
| Arsenic | BDL | 2 |
| Barium | BDL | 100 |
| Beryllium | BDL | 0.5 |
| Cadmium | BDL | 5 |
| Chromium | BDL | 50 |
| Copper | BDL | 20 |
| Lead | BDL | 50 |
| Mercury | BDL | 0.2 |
| Nickel | BDL | 40 |
| Selenium | BDL | 2 |
| Silver | BDL | 10 |
| Thallium | BDL | 100 |
| Zinc | 21 | 5 |

QUALITY CONTROL DUPLICATE OF 113-A

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 6400 | 400 |
| Arsenic | BDL | 6 |
| Barium | 200 | 200 |
| Beryllium | 76 | 10 |
| Cadmium | 818 | 10 |
| Chromium | 160 | 100 |
| Copper | 460 | 40 |
| Lead | 3800 | 100 |
| Mercury | 2.7 | 0.6 |
| Nickel | 3300 | 80 |
| Selenium | 24 | 6 |
| Silver | 340 | 10 |
| Thallium | 3600 | 200 |
| Zinc | 1190 | 10 |

QUALITY CONTROL DUPLICATE OF 106-B

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
| Antimony | 5200 | 400 |
| Arsenic | 6 | 6 |
| Barium | 4400 | 200 |



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| | | |
|-----------|-------|-----|
| Beryllium | 80 | 10 |
| Cadmium | 914 | 10 |
| Chromium | 300 | 100 |
| Copper | 2460 | 40 |
| Lead | 14400 | 100 |
| Mercury | 1.8 | 0.6 |
| Nickel | 3860 | 80 |
| Selenium | 45 | 6 |
| Silver | 3360 | 20 |
| Thallium | 4400 | 200 |
| Zinc | 9750 | 50 |

QUALITY CONTROL SPIKE RECOVERY OF 106-B

| <u>Test</u> | <u>Percent Spike Recovery</u> | <u>Spike Added</u> (ug/l) |
|-------------|-------------------------------|------------------------------|
| Antimony | 110 | 100 |
| Arsenic | 64 | 50 |
| Barium | 80 | 1000 |
| Beryllium | 97 | 1000 |
| Cadmium | 96 | 1000 |
| Chromium | 75 | 1000 |
| Copper | 98 | 1000 |
| Lead | 124 | 1000 |
| Mercury | 41 | 12.5 |
| Nickel | 101 | 1000 |
| Selenium | 22 | 50 |
| Silver | 94 | 1000 |
| Thallium | 80 | 1000 |
| Zinc | 96 | 1000 |

QUALITY CONTROL SPIKE RECOVERY OF 113-A

| <u>Test</u> | <u>Percent Spike Recovery</u> | <u>Spike Added</u> (ug/l) |
|-------------|-------------------------------|------------------------------|
| Antimony | 100 | 1000 |
| Arsenic | 80 | 50 |
| Barium | 120 | 1000 |
| Beryllium | 112 | 1000 |
| Cadmium | 104 | 1000 |
| Chromium | 78 | 1000 |
| Copper | 95 | 1000 |
| Lead | 124 | 1000 |
| Mercury | 25 | 10 |
| Nickel | 108 | 1000 |
| Selenium | 50 | 50 |
| Silver | 99 | 1000 |
| Thallium | 110 | 1000 |
| Zinc | 110 | 1000 |

QUALITY CONTROL SPIKE RECOVERY

| <u>Test</u> | <u>Percent Recovery (%)</u> |
|-------------|-----------------------------|
|-------------|-----------------------------|

| | |
|---------------|-----|
| Total Cyanide | 260 |
|---------------|-----|

QUALITY CONTROL DUPLICATE OF 111-A

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
|-------------|-----------------------------|-------------------|

| | | |
|---------------|-----|----|
| Total Cyanide | 480 | 20 |
|---------------|-----|----|

QUALITY CONTROL DUPLICATE OF 107-B

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
|-------------|-----------------------------|-------------------|

| | | |
|------------------------|----|----|
| Chromium ⁺⁶ | 80 | 10 |
|------------------------|----|----|

QUALITY CONTROL DUPLICATE OF 101-A

| <u>Test</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-------------|-----------------------------|-------------------|
|-------------|-----------------------------|-------------------|

| | | |
|---------|-----|----|
| Cyanide | 500 | 20 |
|---------|-----|----|

RDL: Required Detection Limit

BDL: Below Detection Limit

Client: Boeing Petroleum
Sample: 101-A

Date Extracted: N/A
Date Analyzed : 02/24/87

VOLATILE PRIORITY POLLUTANTS

| <u>Compound</u> | <u>Chromatographic Retention Time</u> (min.) | <u>Concentration</u> (ug/l) | <u>RDL</u> (ug/l) |
|---------------------------|---|--------------------------------|----------------------|
| Chloromethane | | BDL | 10.0 |
| Bromomethane | | BDL | 10.0 |
| Dichlorodifluoromethane | | BDL | 10.0 |
| Vinyl Chloride | | BDL | 10.0 |
| Chloroethane | | BDL | 10.0 |
| Methylene Chloride | 6.10 | 18 B | 10.0 |
| 1,1-Dichloroethene | | BDL | 10.0 |
| 1,1-Dichloroethane | | BDL | 10.0 |
| trans-1,2-Dichloroethane | | BDL | 10.0 |
| Chloroform | | BDL | 10.0 |
| 1,2-Dichloroethane | | BDL | 10.0 |
| 1,1,1-Trichloroethane | | BDL | 10.0 |
| Carbon tetrachloride | | BDL | 10.0 |
| Bromodichloromethane | | BDL | 10.0 |
| 1,2-Dichloropropane | | BDL | 10.0 |
| trans-1,3-Dichloropropene | | BDL | 10.0 |
| Trichloroethene | | BDL | 10.0 |
| Dibromochloroethane | | BDL | 10.0 |
| 1,1,2-Trichloroethane | | BDL | 10.0 |
| Benzene | 16.64 | 28 | 10.0 |
| cis-1,3-Dichloropropene | | BDL | 10.0 |
| 2-Chloroethyl vinyl ether | | BDL | 10.0 |
| Bromoform | | BDL | 10.0 |
| Tetrachloroethene | | BDL | 10.0 |
| 1,1,2,2-Tetrachloroethane | | BDL | 10.0 |
| Toluene | 23.19 | 120 | 10.0 |
| Chlorobenzene | | BDL | 10.0 |
| Ethyl Benzene | 26.22 | 44 | 10.0 |

Associated Blank: Blank #3

SURROGATE RECOVERY %

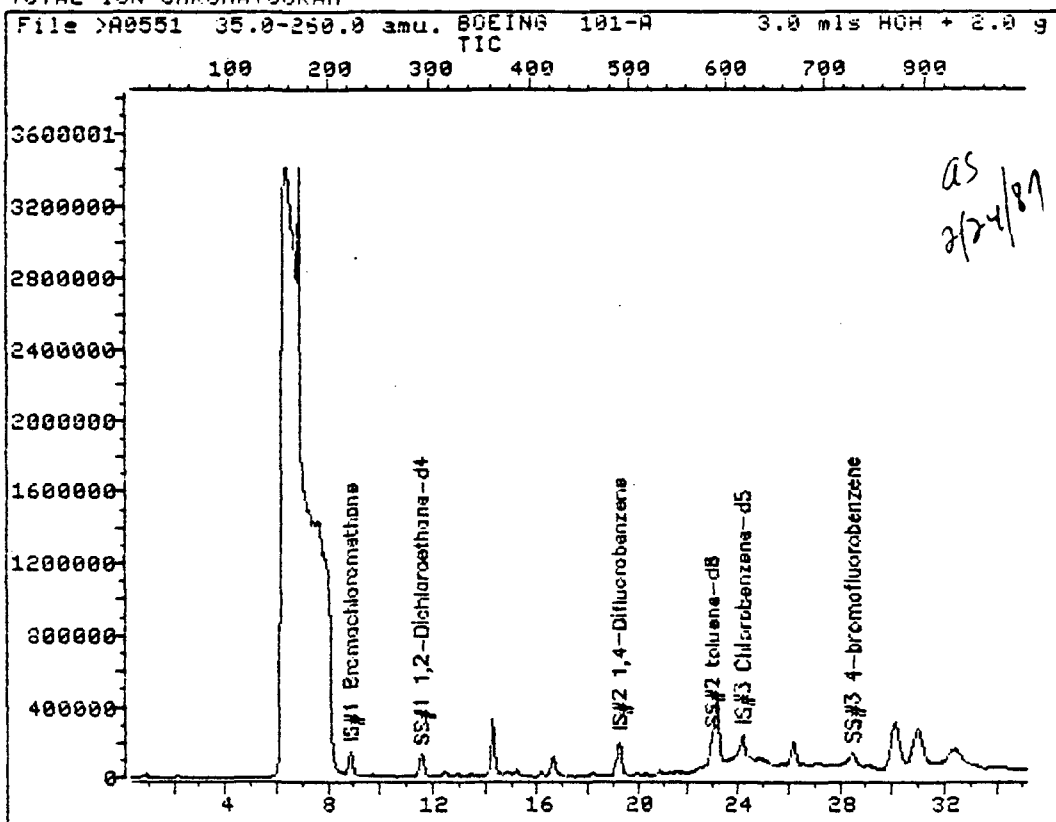
1,2-Dichloroethane 96
Toluene-d8 109
4-Bromofluorobenzene 80

BDL: Below Detection Limit
RDL: Required Detection Limit
** : Below Report Limit, But Detected
B : Detected in Blank
MS : Matrix Spike Compound Level: _____



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

TOTAL ION CHROMATOGRAM



Data File: >A0551::D2
Name: BOEING 101-A
Misc: 3.0 mls HOH + 2.0 g SOIL

Id File: ID_U::D2
Title: HSL VOLATILE ORGANIC ANALYSIS EPA CLP APR86
Last Calibration: 870224 09:11

Operator ID: ANNETTE
Quant Time: 870224 16:44
Injected at: 870224 16:08

Client: Boeing Petroleum
Sample: 101-A

Date Extracted: 02/20/87
Date Analyzed : 02/24/87

BASE/NEUTRAL PRIORITY POLLUTANTS

| <u>Compound</u> | <u>Chromatographic Retention Time (min.)</u> | <u>Concentration (ug/l)</u> | <u>RDL (ug/l)</u> |
|-----------------------------|--|---------------------------------|-----------------------|
| Bis(2-chloroethyl)ether | | BDL | 50.0 |
| 1,3-Dichlorobenzene | | BDL | 50.0 |
| 1,4-Dichlorobenzene | | BDL | 50.0 |
| 1,2-Dichlorobenzene | | BDL | 50.0 |
| Bis(2-Chloroisopropyl)ether | | BDL | 50.0 |
| N-Nitrosodi-n-propylamine | | BDL | 50.0 |
| Hexachloroethane | | BDL | 50.0 |
| Nitrobenzene | | BDL | 50.0 |
| Isophorone | | BDL | 50.0 |
| Bis(2-Chloroethoxy)methane | | BDL | 50.0 |
| 1,2,4-Trichlorobenzene | | BDL | 50.0 |
| Naphthalene | 14.77 | 36 ** | 50.0 |
| Hexachlorobutadiene | | BDL | 50.0 |
| Hexachlorocyclopentadiene | | BDL | 50.0 |
| 2-Chloronaphthalene | | BDL | 50.0 |
| Dimethyl phthalate | | BDL | 50.0 |
| 2,6-Dinitrotoluene | | BDL | 50.0 |
| Acenaphthylene | | BDL | 50.0 |
| Acenaphthene | | BDL | 50.0 |
| 2,4-Dinitrotoluene | | BDL | 50.0 |
| 1,2-Diphenylhydrazine | | BDL | 50.0 |
| Diethyl phthalate | | BDL | 50.0 |
| 4-Chlorophenylphenyl ether | | BDL | 50.0 |
| Fluorene | | BDL | 50.0 |
| N-Nitrosodiphenylamine | 21.04 | 54 | 50.0 |
| 4-Bromophenylphenyl ether | | BDL | 50.0 |
| Hexachlorobenzene | | BDL | 50.0 |
| Phenanthrene | 23.19 | 37 ** | 50.0 |
| Anthracene | | BDL | 50.0 |
| Pyrene | | BDL | 50.0 |
| Di-n-butyl Phthalate | | BDL | 50.0 |
| Fluoranthene | | BDL | 50.0 |
| Benzidine | | BDL | 50.0 |
| Butyl benzyl phthalate | | BDL | 50.0 |
| 3,3'-Dichlorobenzidine | | BDL | 50.0 |
| Benzo(a)anthracene | | BDL | 50.0 |
| Bis(2-ethylhexyl)phthalate | | BDL | 50.0 |
| Chrysene | | BDL | 50.0 |
| Di-n-octyl phthalate | | BDL | 50.0 |
| Benzo(b)fluoranthene | | BDL | 50.0 |

-continued-



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

Client: Boeing Petroleum
Sample: 101-A

| | | |
|-------------------------------|-----|------|
| <u>Benzo(k)fluoranthene</u> | BDL | 50.0 |
| <u>Benzo(a)pyrene</u> | BDL | 50.0 |
| <u>Indeno(1,2,3-cd)pyrene</u> | BDL | 50.0 |
| <u>Dibenzo(a,h)anthracene</u> | BDL | 50.0 |
| <u>Benzo(g,h,i.)perylene</u> | BDL | 50.0 |
| <u>n-Nitrosodimethyl</u> | BDL | 50.0 |
| <u>Bis(chloromethyl)ether</u> | BDL | 50.0 |

Associated Blank: Blank #2

SURROGATE RECOVERY %

| | |
|------------------|----|
| d-5 nitrobenzene | 77 |
| 2-Fluorobiphenyl | 79 |
| d-14-terphenyl | 88 |

RDL: Required Detection Limit
BDL: Below Detection Limit
** : Below Report Limit, but Detected
B : Detected in Blank

Client: Boeing Petroleum
Sample: 101-A

Date Extracted: 02/20/87
Date Analyzed : 02/24/87

ACID EXTRACTABLE PRIORITY POLLUTANTS

| <u>Compound</u> | <u>Chromatographic Retention Time</u> (min.) | <u>Concentration</u> (ug/l) | <u>RDL</u> (ug/l) |
|----------------------------|---|--------------------------------|----------------------|
| Phenol | | BDL | 50.0 |
| 2-Chlorophenol | | BDL | 50.0 |
| 2-Nitrophenol | | BDL | 50.0 |
| 2,4-Dimethylphenol | | BDL | 50.0 |
| 2,4-Dichlorophenol | | BDL | 50.0 |
| 4-Chloro-3-methylphenol | | BDL | 50.0 |
| 2,4,6-Trichlorophenol | | BDL | 50.0 |
| 2,4-Dinitrophenol | | BDL | 50.0 |
| 4-Nitrophenol | | BDL | 50.0 |
| 2-Methyl-4,6-dinitrophenol | | BDL | 50.0 |
| Pentachlorophenol | | BDL | 50.0 |

Associated Blank: Blank #2

SURROGATE RECOVERY %

| | |
|----------------------|----|
| d-5 phenol | 79 |
| 2-fluorophenol | 73 |
| 2,4,6-tribromophenol | 80 |

BDL: Below Detection Limit

RDL: Required Detection Limit

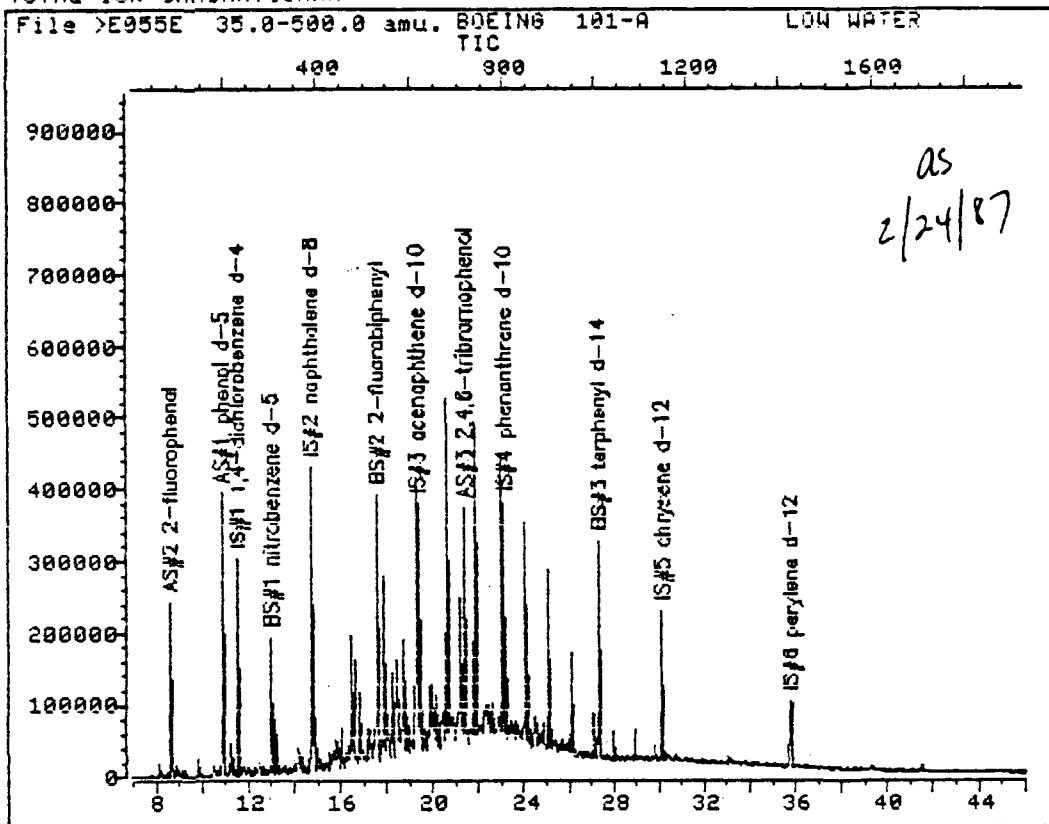
** : Below Report Limit, But Detected

B : Detected in Blank

EIRA

ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

TOTAL ION CHROMATOGRAM



Data File: >E055E::D3

Name: BOEING 101-A

Misc: LOW WATER

Id File: ID_SU::D2

Title: HSL SEMI-VOLATILE ORGANIC ANALYSIS

MAY86

Last Calibration: 870224 10:57

Operator ID: JOE

Quant Time: 870224 11:55

Injected at: 870224 10:48

Client: Boeing Petroleum
Sample: 101-A

Date Extracted: 02/16/87
Date Analyzed : 02/24/87

PESTICIDE/PCB FRACTION

| <u>Compounds</u> | <u>Chromatographic Retention Time</u> (min.) | <u>Concentration</u> (ug/l) | <u>RDL</u> (ug/l) |
|--------------------|---|--------------------------------|----------------------|
| Alpha-BHC | | BDL | 0.083 |
| Beta-BHC | | BDL | 0.083 |
| Delta-BHC | | BDL | 0.083 |
| Gamma-BHC | | BDL | 0.083 |
| Heptachlor | | BDL | 0.083 |
| Aldrin | | BDL | 0.083 |
| Heptachlor Epoxide | | BDL | 0.083 |
| Endosulfan I | | BDL | 0.083 |
| Dieldrin | | BDL | 0.17 |
| 4,4-DEE | | BDL | 0.17 |
| Endrin | | BDL | 0.17 |
| Endosulfan II | | BDL | 0.17 |
| 4,4-DDD | | BDL | 0.17 |
| Endosulfan Sulfate | | BDL | 0.17 |
| 4,4-DDT | | BDL | 0.17 |
| Endrin Ketone | | BDL | 0.17 |
| Methoxychlor | | BDL | 0.83 |
| Chlorodane | | BDL | 0.83 |
| Toxaphene | | BDL | 1.7 |
| PCB 1016 | | BDL | 0.83 |
| PCB 1221 | | BDL | 0.83 |
| PCB 1232 | | BDL | 0.83 |
| PCB 1242 | | BDL | 0.83 |
| PCB 1248 | | BDL | 0.83 |
| PCB 1254 | | BDL | 1.7 |
| PCB 1260 | | BDL | 1.7 |

SURROGATE: Dibutylchloroendate Recovery: 114 %

HERBICIDE FRACTION

| | | |
|--------|-----|------|
| 2,4-D | BDL | 20.0 |
| Silvex | BDL | 65.0 |

SURROGATE: 4-(2-4-Dichlorophenoxy)butyric Acid Recovery: 33 %

RDL: Required Detection Limit

BDL: Below Detection Limit

** : Below Report Limit

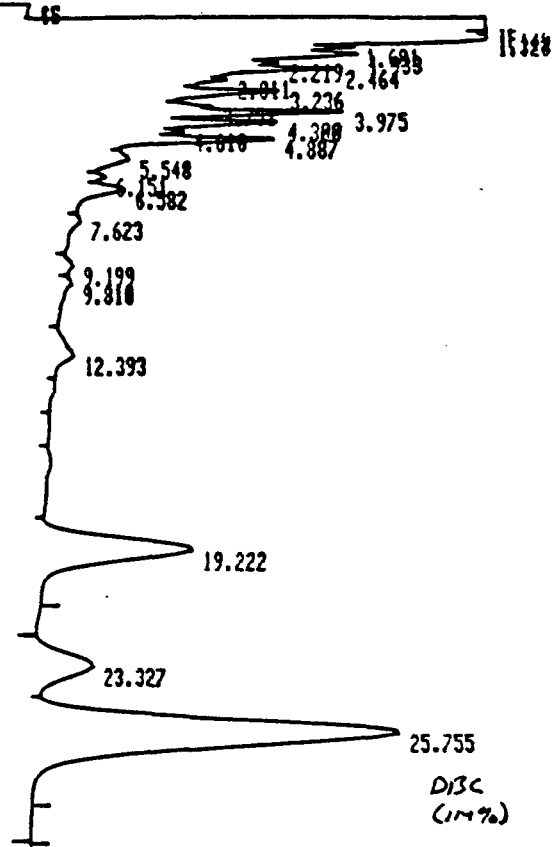
B : Detected in Blank

MS : Matrix Spike Compound Level: _____



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

START



STOP

RUN# 25 FEB 24, 1987 22:47:24

SAMPLE NAME: L# 870159-E SAMPLE# 25
101-A

PESTICIDE/PCBs ON SP2250/SP2401

| RT | AREA | TYPE | WIDTH | AREA% |
|--------|--------|------|-------|----------|
| 1.142 | 7432 | BP | .075 | .41769 |
| 1.323 | 210895 | PP | .118 | 11.85266 |
| 1.681 | 9217 | PV | .117 | .51801 |
| 1.933 | 26827 | VP | .192 | 1.50772 |
| 2.219 | 6416 | PV | .135 | .36059 |
| 2.464 | 27150 | VV | .147 | 1.52588 |
| 2.811 | 2726 | VP | .093 | .15321 |
| 3.236 | 32676 | PP | .187 | 1.83645 |
| 3.751 | 10719 | PV | .127 | .60243 |
| 3.975 | 66121 | VV | .192 | 3.71611 |
| 4.380 | 52252 | VV | .216 | 2.93665 |
| 4.610 | 14519 | VV | .170 | .81599 |
| 4.887 | 58682 | VP | .214 | 3.29803 |
| 5.548 | 15179 | PP | .372 | .85309 |
| 6.151 | 5334 | PV | .217 | .29978 |
| 6.582 | 25468 | VP | .343 | 1.43135 |
| 7.623 | 5357 | PP | .387 | .30107 |
| 9.199 | 8122 | PV | .454 | .45647 |
| 9.810 | 12595 | VP | .640 | .70786 |
| 12.393 | 20568 | PV | .774 | 1.60557 |
| 19.222 | 251080 | PB | .865 | 14.15609 |
| 23.327 | 111206 | BV | 1.005 | 6.24997 |
| 25.755 | 789964 | VB | 1.134 | 44.39734 |

TOTAL AREA=1779305
MUL FACTOR=1.0000E+00

RUN # 38 FEB 25, 1987 16:09:19

START

IF

1E887

1.742

3.878

4.201

4.813 2,4-DB

6.740

STOP

Closing signal file M:SIGNAL .BNC

RUN# 38 FEB 25, 1987 16:09:19

SAMPLE NAME: L# 870159-E SAMPLE# 53
101-A

SIGNAL FILE: M:SIGNAL.BNC

HERBICIDE ANALYSIS

ESTD

| RT | TYPE | AREA | WIDTH | HEIGHT |
|-------|------|--------|-------|--------|
| 1.087 | BP | 5931 | .059 | 1672 |
| 1.428 | PP | 13268 | .106 | 2091 |
| 1.742 | PY | 18956 | .235 | 1347 |
| 3.878 | YP | 35993 | .525 | 1143 |
| 4.201 | PP | 20543 | .757 | 452 |
| 4.813 | PB | 339866 | .229 | 24685 |
| 6.740 | BB | 44765 | .495 | 1506 |

| RT | CAL# | ug/mL | NAME |
|-------|------|--------|--------|
| 1.087 | | .000 | |
| 1.428 | | .000 | |
| 1.742 | | .000 | |
| 3.878 | | .000 | |
| 4.201 | | .000 | |
| 4.813 | 3R | 32.965 | 2,4-DB |
| 6.740 | | .000 | |

TOTAL AREA= 479322

MUL FACTOR=1.0000E+00

LABORATORY REPORT FOR BRYAN MOUND MUD PIT AND
CAVERNS 4 AND 5

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES
2445 Florida Avenue
Kenner, Louisiana 70062
(504) 469-0333

LABORATORY REPORT

Prepared For: Boeing Petroleum Services, Inc.

Sample Description: 5 six foot Core Soil Samples

Laboratory Number: 860991
Date Received: 09/24/86

Job Number: Not Supplied
Sampled By: E.I.R.A.

Analyses Requested: EP Toxicity, Pesticides, Herbicides, Metals, and Asbestos

RESULTS

Midpoint

| <u>Metal</u> | <u>Concentration</u> (mg/l) | <u>Duplicate</u> <u>Results</u> (mg/l) | <u>* RDL</u> (mg/l) |
|---------------------|--------------------------------|--|------------------------|
| Mercury | 0.0055 | | 0.0002 |
| Arsenic | BDL | | 0.002 |
| Selenium | BDL | | 0.002 |
| Barium | 0.26 | | 0.10 |
| Cadmium | 0.013 | | 0.005 |
| Chromium | 0.07 | | 0.05 |
| Lead | 0.22 | | 0.05 |
| Silver | 0.03 | | 0.01 |
| Hexavalent Chromium | Not Required | | 0.05 |

Northwest

| <u>Metal</u> | <u>Concentration</u> (mg/l) | <u>Duplicate</u> <u>Results</u> (mg/l) | <u>* RDL</u> (mg/l) |
|---------------------|--------------------------------|--|------------------------|
| Mercury | 0.0019 | | 0.0002 |
| Arsenic | 0.008 | | 0.002 |
| Selenium | BDL | 0.002 | 0.002 |
| Barium | 0.13 | | 0.10 |
| Cadmium | 0.019 | | 0.005 |
| Chromium | 0.06 | | 0.05 |
| Lead | 0.26 | | 0.05 |
| Silver | 0.04 | | 0.01 |
| Hexavalent Chromium | Not Required | | 0.05 |

-continued-



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

Northeast

| <u>Metal</u> | <u>Concentration</u> (mg/l) | <u>Duplicate</u> <u>Results</u> (mg/l) | <u>* RDL</u> (mg/l) |
|---------------------|--------------------------------|--|------------------------|
| Mercury | 0.0045 | | 0.0002 |
| Arsenic | BDL | | 0.002 |
| Selenium | 0.002 | | 0.002 |
| Barium | 0.22 | | 0.10 |
| Cadmium | 0.014 | | 0.005 |
| Chromium | BDL | | 0.05 |
| Lead | 0.19 | | 0.05 |
| Silver | 0.02 | | 0.01 |
| Hexavalent Chromium | Not Required | | 0.05 |

Southeast

| <u>Metal</u> | <u>Concentration</u> (mg/l) | <u>Duplicate</u> <u>Results</u> (mg/l) | <u>* RDL</u> (mg/l) |
|---------------------|--------------------------------|--|------------------------|
| Mercury | 0.0033 | 0.0034 | 0.0002 |
| Arsenic | 0.022 | | 0.002 |
| Selenium | BDL | | 0.002 |
| Barium | 0.30 | | 0.10 |
| Cadmium | 0.027 | | 0.005 |
| Chromium | 0.10 | | 0.05 |
| Lead | 0.31 | | 0.05 |
| Silver | 0.05 | | 0.01 |
| Hexavalent Chromium | Not Required | | 0.05 |

Southwest

| <u>Metal</u> | <u>Concentration</u> (mg/l) | <u>Duplicate</u> <u>Results</u> (mg/l) | <u>* RDL</u> (mg/l) |
|---------------------|--------------------------------|--|------------------------|
| Mercury | 0.0015 | | 0.0002 |
| Arsenic | 0.005 | 0.006 | 0.002 |
| Selenium | 0.002 | | 0.002 |
| Barium | 0.30 | | 0.10 |
| Cadmium | 0.020 | | 0.005 |
| Chromium | BDL | | 0.05 |
| Lead | 2.12 | 2.10 | 0.05 |
| Silver | 0.03 | | 0.01 |
| Hexavalent Chromium | Not Required | | 0.05 |

-continued-

Metals

Spike Recoveries for Samples
Run Concurrently (%)

| | |
|----------|-----|
| Mercury | 79 |
| Arsenic | 74 |
| Selenium | 73 |
| Barium | 91 |
| Cadmium | 103 |
| Chromium | 91 |
| Lead | 77 |
| Silver | 92 |

RDL: Required Detection Limit

BDL: Below Detection Limit

* Herbicides and Pesticides Results are Attached *

Client: Boeing Petroleum (#991)
Sample: Midpoint

Date Extracted: 10/01/86
Date Analyzed: 10/08/86
Time Analyzed: 1054

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection Limit</u> ($\mu\text{g/l}$) |
|--------------|---|---|
| Gamma-BHC | BDL | 5.0 |
| Methoxychlor | BDL | 50.0 |
| Toxaphene | BDL | 100.0 |
| Endrin | BDL | 10.0 |

SURROGATE:
Dibutylchloroendate Recovery %: 89

Date Extracted: 09/27/86
Date Analyzed: 09/29/86
Time Analyzed: 1536

HERBICIDE FRACTION

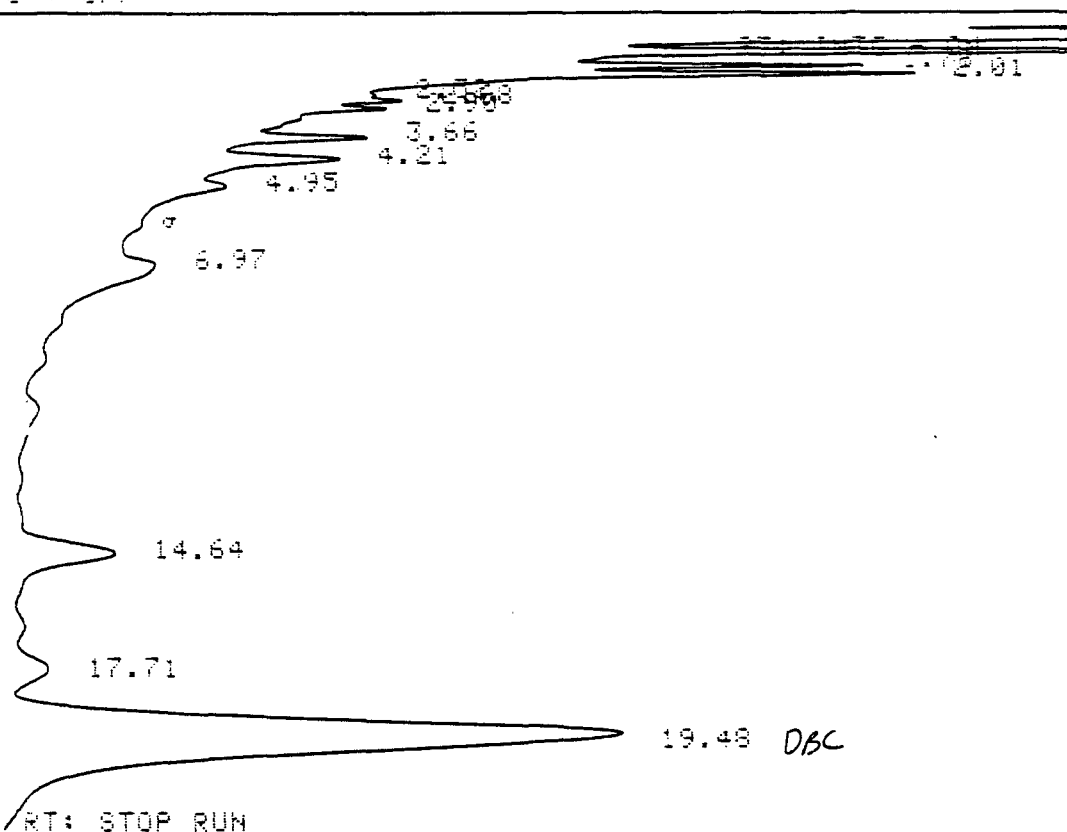
| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection Limit</u> ($\mu\text{g/l}$) |
|--------|---|---|
| 2,4-D | BDL | 35.0 |
| Silvex | BDL | 35.0 |

SURROGATE:
4 - (2,4-Dichlorophenoxy) butyric acid Recovery %: 36

BDL: Below Detection Limit
** Below Report Limit, but detected
B: Detected in Blank
DL: Diluted Out
MS: Matrix Spike Compound added at a level of:

READY FOR INJECTION

RT: INTG + OFF



RT: STOP RUN

RUN # 7 PESTICIDE ANALYSIS

LAB #: 991

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

VOL. INJ.: 3 µL

SAMPLE ID: MIDPOINT

HP 5880A MANUAL INJECTION @ 10:54 OCT 8, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.78 | 8225.84 | BV | 4.296 |
| 2.01 | 13775.50 | VP | 7.194 |
| 2.52 | 284.73 | PV | 0.149 |
| 2.68 | 1529.11 | VV | 0.799 |
| 2.90 | 1580.90 | VB | 0.826 |
| 3.66 | 4629.24 | BP | 2.417 |
| 4.21 | 7425.92 | PV | 3.878 |
| 4.95 | 2006.76 | VP | 1.048 |
| 6.97 | 7472.30 | BB | 3.902 |
| 14.64 | 12820.60 | BB | 6.695 |
| 17.71 | 4740.79 | VV | 2.476 |
| 19.48 | 127006.00 | A VP | 66.322 |

TOTAL AREA = 191498.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

5.04 2,4-DB

RT: STOP RUN

HERBICIDE ANALYSIS LAB #: 991
SAMPLE ID: MIDPOINT CLIENT: BOEING PETROLEUM
COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401 VOL. INJ.: 3 UL
[HP] 5880A MANUAL INJECTION @ 15:36 SEP 29, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|------|----------|------|---------|
| 5.04 | 23779.30 | 88 | 100.000 |

TOTAL AREA = 23779.30

MULTIPLIER = 1

Client: Boeing Petroleum (#991)
Sample: Northwest

Date Extracted: 10/01/86
Date Analyzed: 10/08/86
Time Analyzed: 1028

PESTICIDE FRACTION

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.0 |
| Methoxychlor | BDL | 50.0 |
| Toxaphene | BDL | 100.0 |
| Endrin | BDL | 10.0 |

SURROGATE:

Dibutylchlorendate Recovery %: 114

Date Extracted: 09/27/86
Date Analyzed: 09/29/86
Time Analyzed: 1401

HERBICIDE FRACTION

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------|--------------------------------|----------------------------------|
| 2,4-D | BDL | 35.0 |
| Silvex | BDL | 35.0 |

SURROGATE:

4 - (2,4-Dichlorophenoxy) butyric acid Recovery %: 39

BDL: Below Detection Limit

** Below Report Limit, but detected

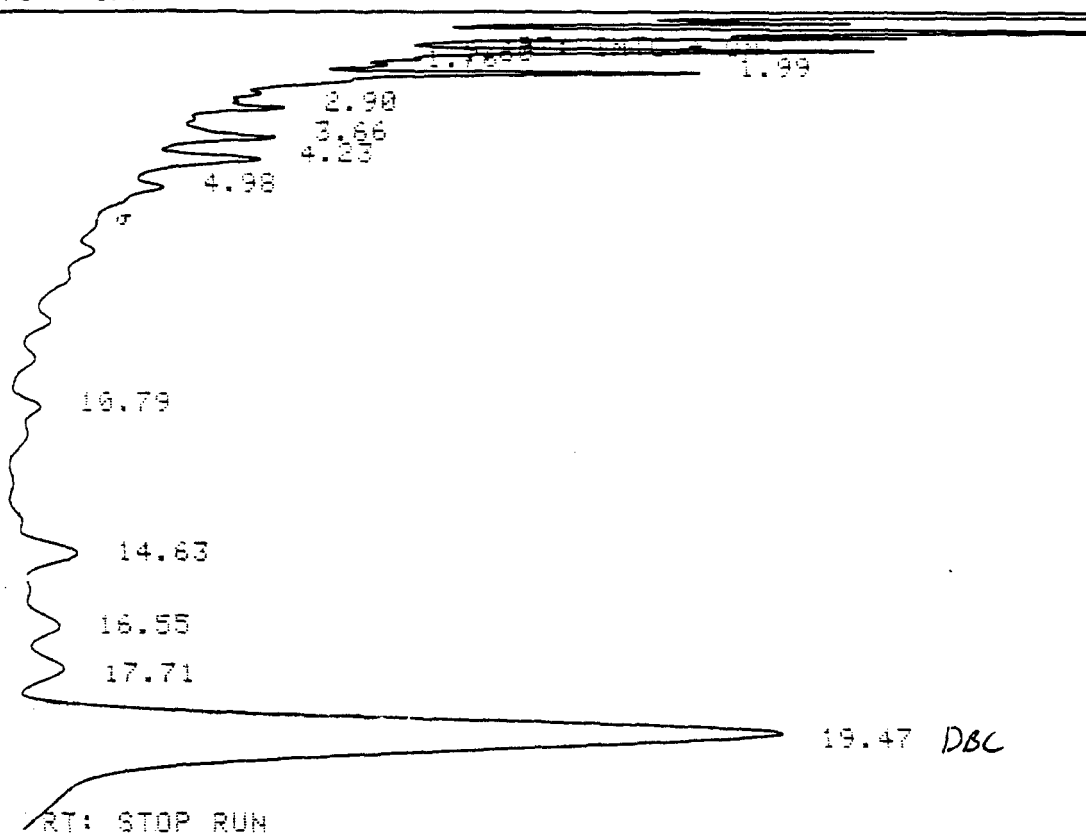
B: Detected in Blank

DL: Diluted Out

MS: Matrix Spike Compound added at a level of:

READY FOR INJECTION

RT: INTG + OFF



RT: STOP RUN

RUN # 6

PESTICIDE ANALYSIS

LAB #: 991

QUANTITATION RUN

CLIENT: SPS

COLUMN: 6 FT X 4 MM 3% SP-2250

VOL. INJ.: 3 µL

SAMPLE ID: NORTHWEST

【hp】 5080A MANUAL INJECTION @ 10:28 OCT 8, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.60 | 272.64 | BP | 0.130 |
| 1.76 | 680.29 | PP | 0.324 |
| 1.99 | 11477.20 | PP | 5.466 |
| 2.90 | 2137.69 | VP | 1.018 |
| 3.66 | 4947.87 | VV | 2.356 |
| 4.23 | 5710.81 | VV | 2.720 |
| 4.98 | 1964.72 | VP | 0.936 |
| 10.79 | 1790.01 | PB | 0.852 |
| 14.63 | 6842.72 | PH | 3.259 |
| 16.55 | 5543.13 | HH | 2.640 |
| 17.71 | 6181.00 | HH | 2.944 |
| 19.47 | 162438.00 | A HH | 77.357 |

TOTAL AREA = 209986.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON
1.43

5.07 2,4-DB

RT: STOP RUN

HERBICIDE ANALYSIS

LAB #: 991

SAMPLE ID: NORTHWEST CLIENT: ROFINO PETROLEUM

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 UL

INP: 5880A MANUAL INJECTION @ 14:01 SEP 29, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|----------|------|---------|
| 5.07 | 25450.70 | SH | 100.000 |

TOTAL AREA = 25450.70

MULTIPLIER = 1

Client: Boeing Petroleum (#991)
Sample: Northeast

Date Extracted: 10/01/86
Date Analyzed: 10/08/86
Time Analyzed: 0854

PESTICIDE FRACTION

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.0 |
| Methoxychlor | BDL | 50.0 |
| Toxaphene | BDL | 100.0 |
| Endrin | BDL | 10.0 |

SURROGATE:

Dibutylchlorendate Recovery %: 85

Date Extracted: 09/27/86
Date Analyzed: 09/29/86
Time Analyzed: 1330

HERBICIDE FRACTION

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------|--------------------------------|----------------------------------|
| 2,4-D | BDL | 35.0 |
| Silvex | BDL | 35.0 |

SURROGATE:

4 - (2,4-Dichlorophenoxy) butyric acid Recovery %: 68

BDL: Below Detection Limit

** Below Report Limit, but detected

B: Detected in Blank

DL: Diluted Out

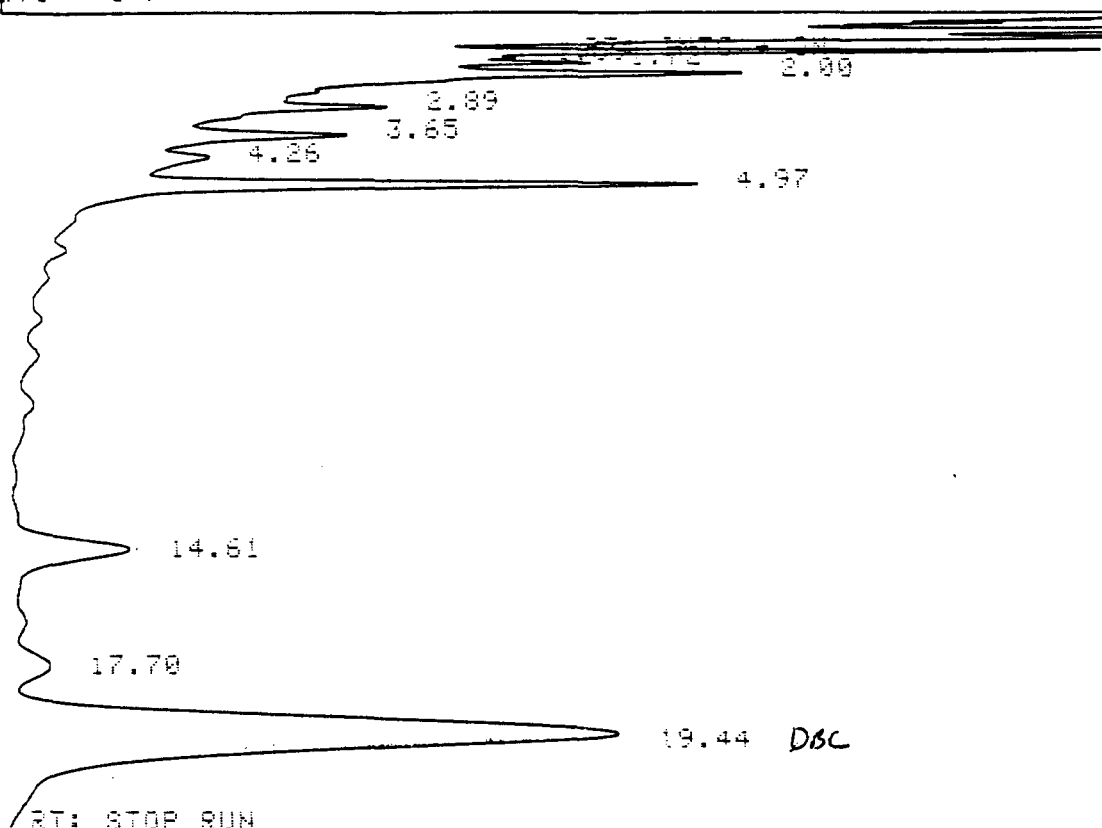
MS: Matrix Spike Compound added at a level of:

EIRA

ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

READY FOR INJECTION

RT: INTG + OFF



RT: STOP RUN

RUN # 2 PESTICIDE ANALYSIS

LPO #: 201

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

VOL. INJ.: 3 µL

SAMPLE ID: NORTHEAST

HP 5880A MANUAL INJECTION @ 08:54 OCT 8, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.59 | 306.50 | SV | 0.151 |
| 1.72 | 2350.94 | VV | 1.163 |
| 2.00 | 12945.30 | VP | 6.383 |
| 2.89 | 4475.04 | VP | 2.206 |
| 3.65 | 7609.18 | PV | 3.752 |
| 4.26 | 4258.96 | VV | 2.100 |
| 4.97 | 29855.30 | VB | 14.720 |
| 14.61 | 14901.50 | BP | 7.347 |
| 17.70 | 4704.51 | VV | 2.320 |
| 19.44 | 121399.00 | A VP | 59.857 |

TOTAL AREA = 202815.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

5.03 2,4-D

RT: STOP RUN

HERBICIDE ANALYSIS

LAB #: 991

SAMPLE ID: NORTHEAST CLIENT: BOEING PETROLEUM

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401 VOL. INJ.: 3 UL

INP 5880A MANUAL INJECTION @ 13:30 SEP 29, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|----------|------|---------|
| 5.03 | 44522.70 | BB | 100.000 |

TOTAL AREA = 44522.70

MULTIPLIER = 1

Client: Boeing Petroleum (#991)
Sample: Northeast Matrix Spike

Date Extracted: 10/01/86
Date Analyzed: 10/08/86
Time Analyzed: 0918

PESTICIDE FRACTION

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.0 |
| Methoxychlor | BDL | 50.0 |
| Toxaphene | BDL | 100.0 |
| Endrin | BDL | 10.0 |

SURROGATE:

Dibutylchloroendate Recovery %: 83

Date Extracted: 09/27/86
Date Analyzed: 09/29/86
Time Analyzed: 1621

HERBICIDE FRACTION

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|----------|--------------------------------|----------------------------------|
| 2,4-D MS | (49% Recovery) | 35.0 |
| Silvex | BDL | 35.0 |

SURROGATE:

4 - (2,4-Dichlorophenoxy) butyric acid Recovery %: 38

BDL: Below Detection Limit

** Below Report Limit, but detected

B: Detected in Blank

DL: Diluted Out

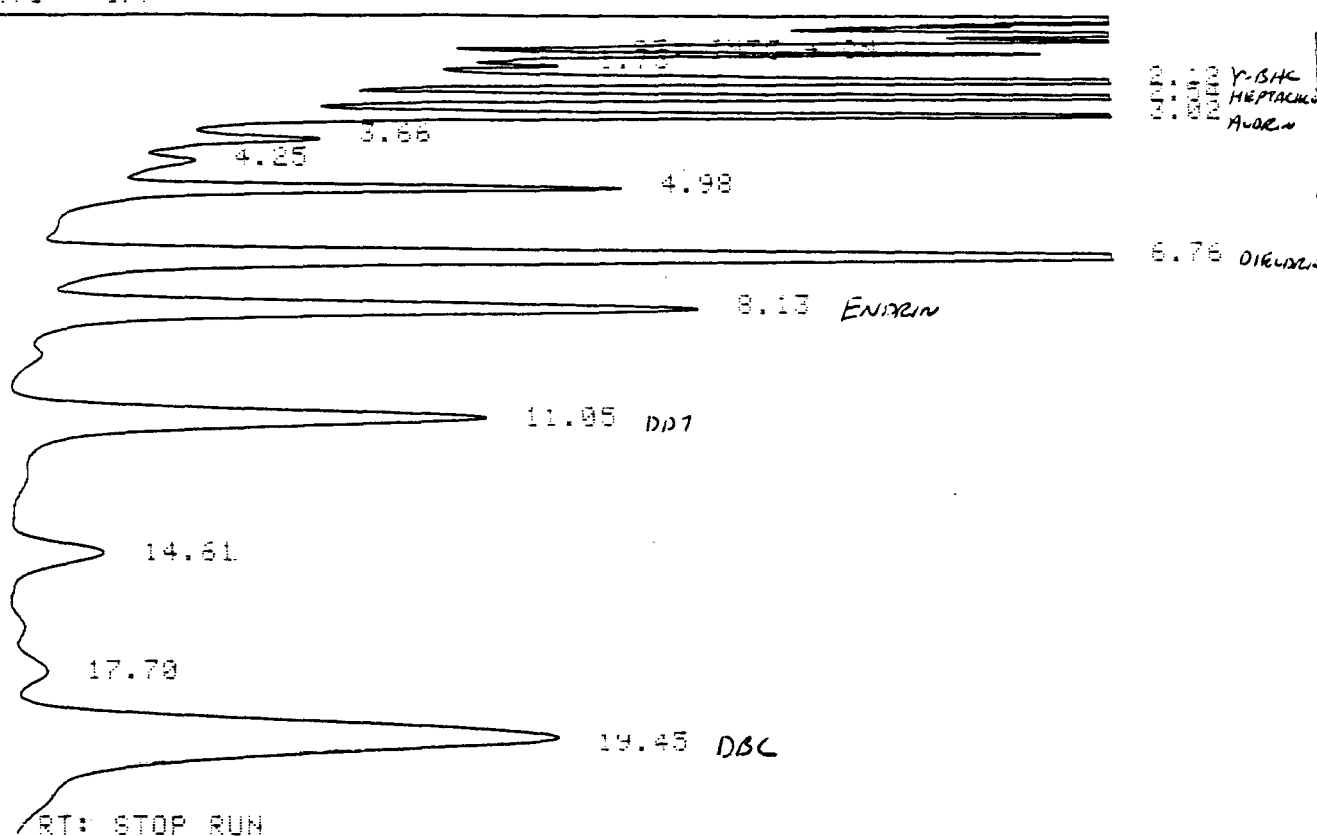
MS: Matrix Spike Compound added at a level of: 200 µ/l Lindane
500 µ/l Endrin
500 µ/l 2,4-DB



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

READY FOR INJECTION

RT: INTG + OFF



RUN # 3 PESTICIDE ANALYSIS
QUANTITATION RUN

LAB #: 991
CLIENT: SPS
VOL. INJ.: 3 µL

COLUMN: 6 FT X 4 MM 3% SP-2250
SAMPLE ID: NORTHEAST (MATRIX SPIKE)

HP 5880A MANUAL INJECTION @ 09:18 OCT 8, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.73 | 1575.89 | SP | 0.307 |
| 2.12 | 52039.60 | PV | 10.125 |
| 2.54 | 37725.90 | VV | 7.340 |
| 3.02 | 40896.20 | VP | 7.957 |
| 3.66 | 6053.24 | PP | 1.178 |
| 4.25 | 3712.08 | PV | 0.722 |
| 4.98 | 27017.30 | VB | 5.257 |
| 6.76 | 96315.70 | BV | 18.740 |
| 8.13 | 59136.00 | VV | 11.506 |
| 11.05 | 53367.90 | PB | 10.384 |
| 14.61 | 12334.40 | PP | 2.400 |
| 17.70 | 5615.88 | HH | 1.093 |
| 19.45 | 118167.00 | A HH | 22.992 |

TOTAL AREA = 513958.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTC + OFF

RT: INTC + ON

2.55 2,4-D

5.02 2,4-D

RT: STOP RUN

HERSICIDE ANALYSIS

LAB #: 991

SAMPLE ID: NORTHEAST MATRIX SPIKE CLIENT: BOEING PETROLEUM

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401 VOL. INJ.: 3 UL

HP 5980A MANUAL INJECTION @ 16:21 SEP 29, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|----------|------|--------|
| 1.42 | 2949.31 | BB | 7.295 |
| 2.55 | 24229.30 | SV | 59.192 |
| 5.02 | 13754.60 | BB | 33.603 |

TOTAL AREA = 40933.20

MULTIPLIER = 1

Client: Boeing Petroleum (#991)
Sample: Southeast

Date Extracted: 10/01/86
Date Analyzed: 10/08/86
Time Analyzed: 0942

PESTICIDE FRACTION

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.0 |
| Methoxychlor | BDL | 50.0 |
| Toxaphene | BDL | 100.0 |
| Endrin | BDL | 10.0 |

SURROGATE:

Dibutylchlorendate Recovery %: 97

Date Extracted: 09/27/86
Date Analyzed: 09/29/86
Time Analyzed: 1459

HERBICIDE FRACTION

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------|--------------------------------|----------------------------------|
| 2,4-D | BDL | 35.0 |
| Silvex | BDL | 35.0 |

SURROGATE:

4 - (2,4-Dichlorophenoxy) butyric acid Recovery %: 38

BDL: Below Detection Limit

** Below Report Limit, but detected

B: Detected in Blank

DL: Diluted Out

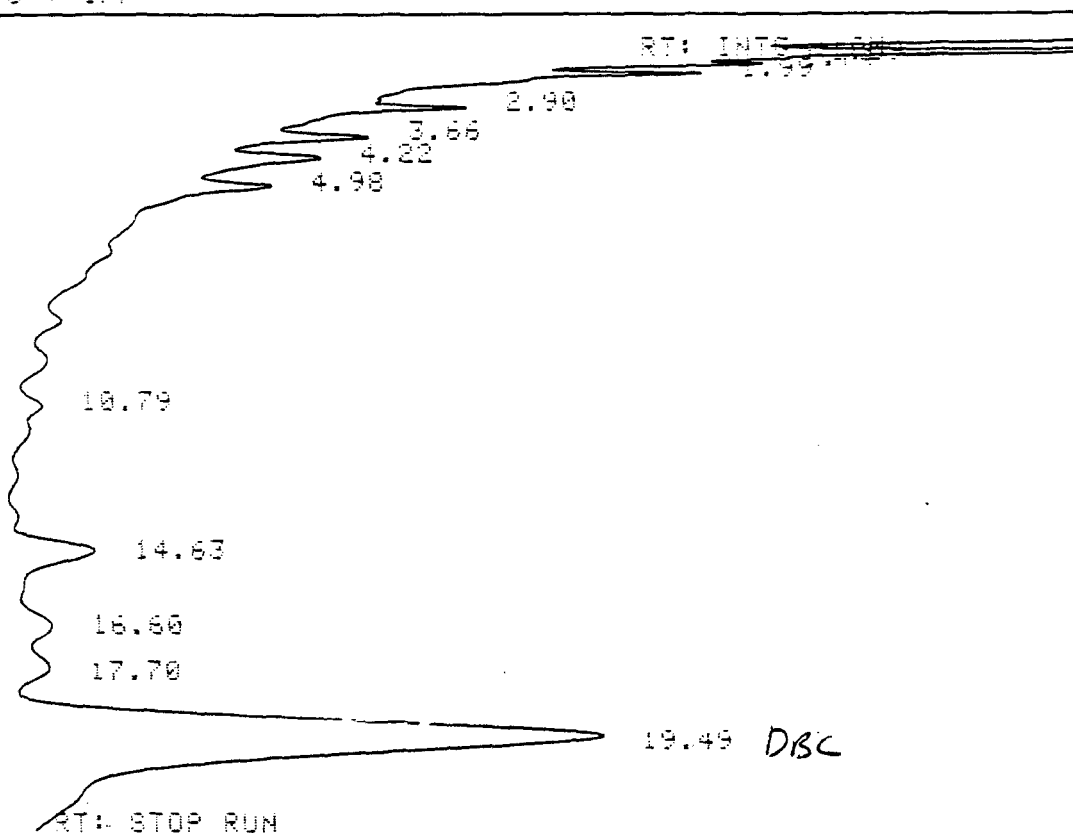
MS: Matrix Spike Compound added at a level of:



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RESEARCH ASSOCIATES, INC.

READY FOR INJECTION

RT: INTG + OFF



RUN # 4 PESTICIDE ANALYSIS

LAB #: 991

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

VOL. INJ.: 3 µL

SAMPLE ID: SOUTHEAST

MANUAL INJECTION @ 09:42 OCT 8, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.59 | 233.69 | BP | 0.124 |
| 1.74 | 1917.93 | PP | 1.021 |
| 1.99 | 4780.10 | PP | 2.546 |
| 2.90 | 4298.02 | VP | 2.289 |
| 3.66 | 4362.79 | PP | 2.324 |
| 4.22 | 5969.49 | PV | 3.179 |
| 4.98 | 3369.25 | VP | 1.794 |
| 10.79 | 2259.89 | PV | 1.204 |
| 14.63 | 11374.20 | PH | 6.058 |
| 16.60 | 5694.33 | HH | 3.033 |
| 17.70 | 5351.02 | HH | 2.850 |
| 19.49 | 138147.00 | A HH | 73.577 |

TOTAL AREA = 187757.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

5.07 2,4-DB

RT: STOP RUN

HERBICIDE ANALYSIS LAB #: 991
SAMPLE ID: SOUTHEAST CLIENT: BOEING PETROLEUM
COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401 VOL. INJ.: 3 UL
[HP] 5880A MANUAL INJECTION @ 14:59 SEP 29, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|------|----------|------|--------|
| 1.44 | 3123.86 | SP | 11.087 |
| 5.07 | 25052.50 | SB | 88.913 |

TOTAL AREA = 28176.30

MULTIPLIER = 1

Client: Boeing Petroleum (#991)
Sample: Southwest

Date Extracted: 10/01/86
Date Analyzed: 10/08/86
Time Analyzed: 1005

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection Limit</u> ($\mu\text{g/l}$) |
|--------------|---|---|
| Gamma-BHC | BDL | 5.0 |
| Methoxychlor | BDL | 50.0 |
| Toxaphene | BDL | 100.0 |
| Endrin | BDL | 10.0 |

SURROGATE:

Dibutylchlorendate Recovery %: 57

Date Extracted: 09/27/86
Date Analyzed: 09/29/86
Time Analyzed: 1513

HERBICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>Detection Limit</u> ($\mu\text{g/l}$) |
|--------|---|---|
| 2,4-D | BDL | 35.0 |
| Silvex | BDL | 35.0 |

SURROGATE:

4 - (2,4-Dichlorophenoxy) butyric acid Recovery %: 49

BDL: Below Detection Limit

** Below Report Limit, but detected

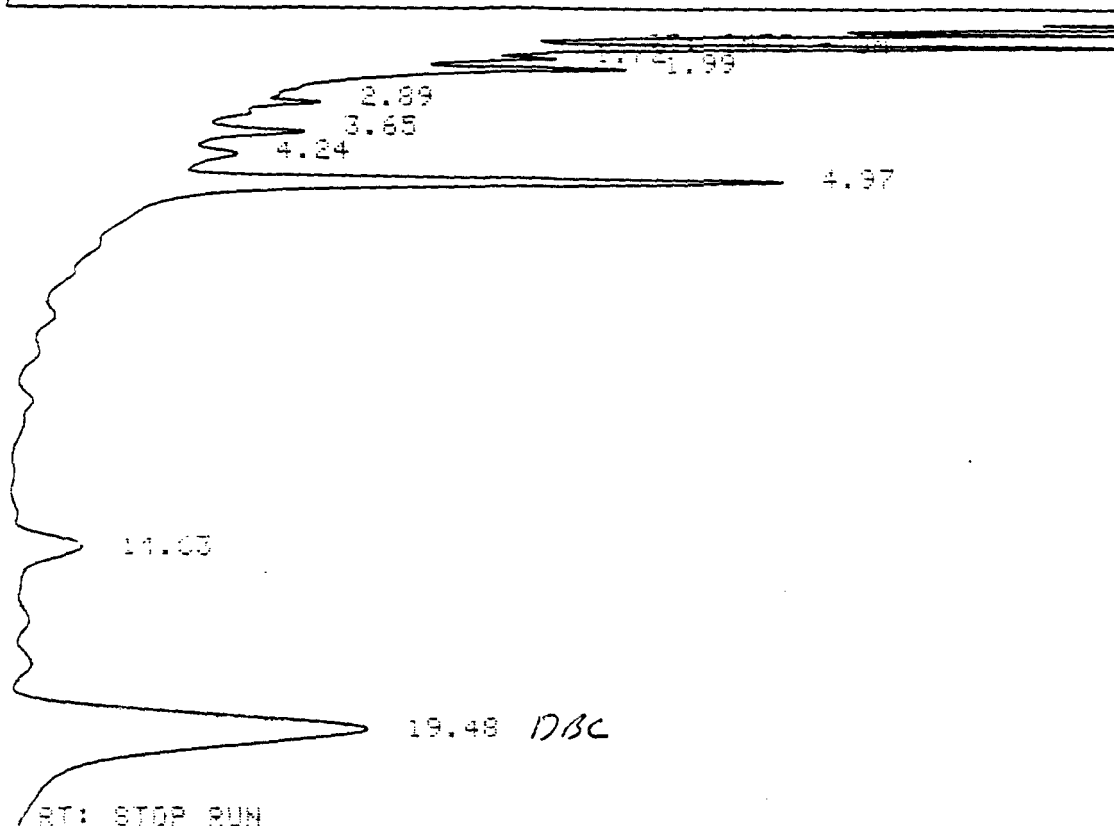
B: Detected in Blank

DL: Diluted Out

MS: Matrix Spike Compound added at a level of:

READY FOR INJECTION

RT: INTG + OFF



RUN # 5

PESTICIDE ANALYSIS
QUANTITATION RUN

LAB #: 991

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

VOL. INJ.: 3 µL

SAMPLE ID: SOUTHWEST

HP 5890A MANUAL INJECTION @ 10:05 OCT 8, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|----------|------|--------|
| 1.72 | 11908.30 | VV | 6.782 |
| 1.99 | 25342.60 | VB | 14.434 |
| 2.89 | 1794.87 | BV | 1.022 |
| 3.65 | 4098.30 | PV | 2.790 |
| 4.24 | 4314.03 | VV | 2.457 |
| 4.97 | 37024.20 | VB | 21.087 |
| 14.63 | 9391.27 | PV | 5.349 |
| 19.48 | 80903.00 | A PH | 46.078 |

TOTAL AREA = 175577.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

1.43 INTG + ON

5.03 2,4-DB

RT: STOP RUN

HERBICIDE ANALYSIS

LAB #: 991

SAMPLE ID: SOUTHWEST CLIENT: BOEING PETROLEUM

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 UL

MANUAL INJECTION @ 15:13 SEP 29, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|----------|------|--------|
| 1.43 | 2173.87 | BB | 6.339 |
| 5.03 | 32129.50 | BB | 93.661 |

TOTAL AREA = 34294.30

MULTIPLIER = 1

Client: Boeing Petroleum (#991)
Sample: Southwest (Duplicate)

Date Extracted: 10/01/86
Date Analyzed: 10/08/86
Time Analyzed: 1028

PESTICIDE FRACTION

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.0 |
| Methoxychlor | BDL | 50.0 |
| Toxaphene | BDL | 100.0 |
| Endrin | BDL | 10.0 |

SURROGATE:

Dibutylchloroendate Recovery %: 114

Date Extracted: 09/27/86
Date Analyzed: 09/29/86
Time Analyzed: 1401

HERBICIDE FRACTION

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------|--------------------------------|----------------------------------|
| 2,4-D | BDL | 35.0 |
| Silvex | BDL | 35.0 |

SURROGATE:

4 - (2,4-Dichlorophenoxy) butyric acid Recovery %: 39

BDL: Below Detection Limit

** Below Report Limit, but detected

B: Detected in Blank

DL: Diluted Out

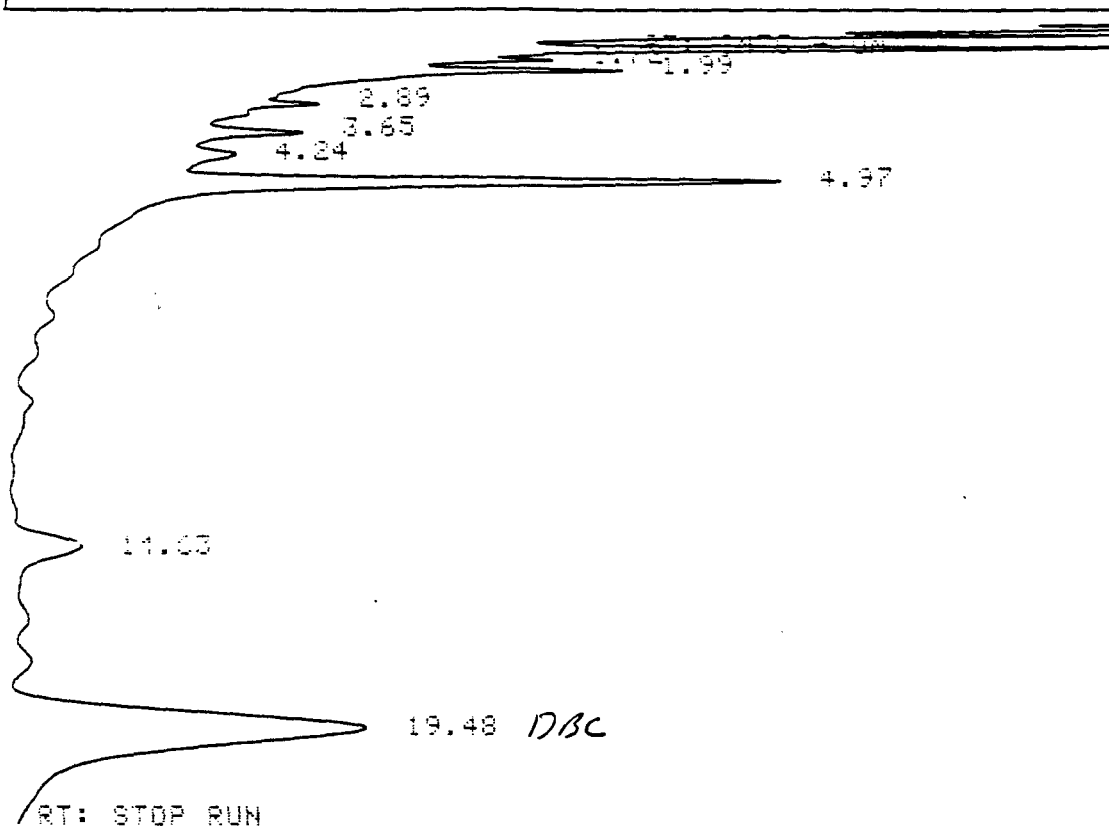
MS: Matrix Spike Compound added at a level of:



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

READY FOR INJECTION

RT: INTG + OFF



RT: STOP RUN

RUN # 5 PESTICIDE ANALYSIS

LAB #: 991

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

VOL. INJ.: 3 AL

SAMPLE ID: SOUTHWEST

INP 5880A MANUAL INJECTION @ 10:05 OCT 8, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|----------|------|--------|
| 1.72 | 11908.30 | VV | 6.782 |
| 1.99 | 25342.60 | VB | 14.434 |
| 2.89 | 1794.87 | BV | 1.022 |
| 3.65 | 4898.30 | PV | 2.790 |
| 4.24 | 4314.03 | VV | 2.457 |
| 4.97 | 37024.20 | VB | 21.087 |
| 14.63 | 9391.27 | PV | 5.349 |
| 19.48 | 80903.00 | A PH | 46.078 |

TOTAL AREA = 175577.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON
1.43

5.03 2,4-DB

RT: STOP RUN

HERBICIDE ANALYSIS LAB #: 991
SAMPLE ID: SOUTHWEST CLIENT: BOEING PETROLEUM
COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401 VOL. INJ.: 3 UL
[HP] 5880A MANUAL INJECTION @ 15:13 SEP 29, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|------|----------|------|--------|
| 1.43 | 2173.87 | BB | 6.339 |
| 5.03 | 32120.50 | BB | 93.661 |

TOTAL AREA = 34294.30
MULTIPLIER = 1

Client: Boeing Petroleum (#991)
Sample: Lab Blank

Date Extracted: 10/01/86
Date Analyzed: 10/08/86
Time Analyzed: 0823

PESTICIDE FRACTION

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------------|--------------------------------|----------------------------------|
| Gamma-BHC | BDL | 5.0 |
| Methoxychlor | BDL | 50.0 |
| Toxaphene | BDL | 100.0 |
| Endrin | BDL | 10.0 |

SURROGATE:

Dibutylchlorendate Recovery %: 119

Date Extracted: 09/27/86
Date Analyzed: 09/29/86
Time Analyzed: 1318

HERBICIDE FRACTION

| | <u>Concentration</u> (µg/l) | <u>Detection Limit</u> (µg/l) |
|--------|--------------------------------|----------------------------------|
| 2,4-D | BDL | 35.0 |
| Silvex | BDL | 35.0 |

SURROGATE:

4 - (2,4-Dichlorophenoxy) butyric acid Recovery %: 48

BDL: Below Detection Limit

** Below Report Limit, but detected

B: Detected in Blank

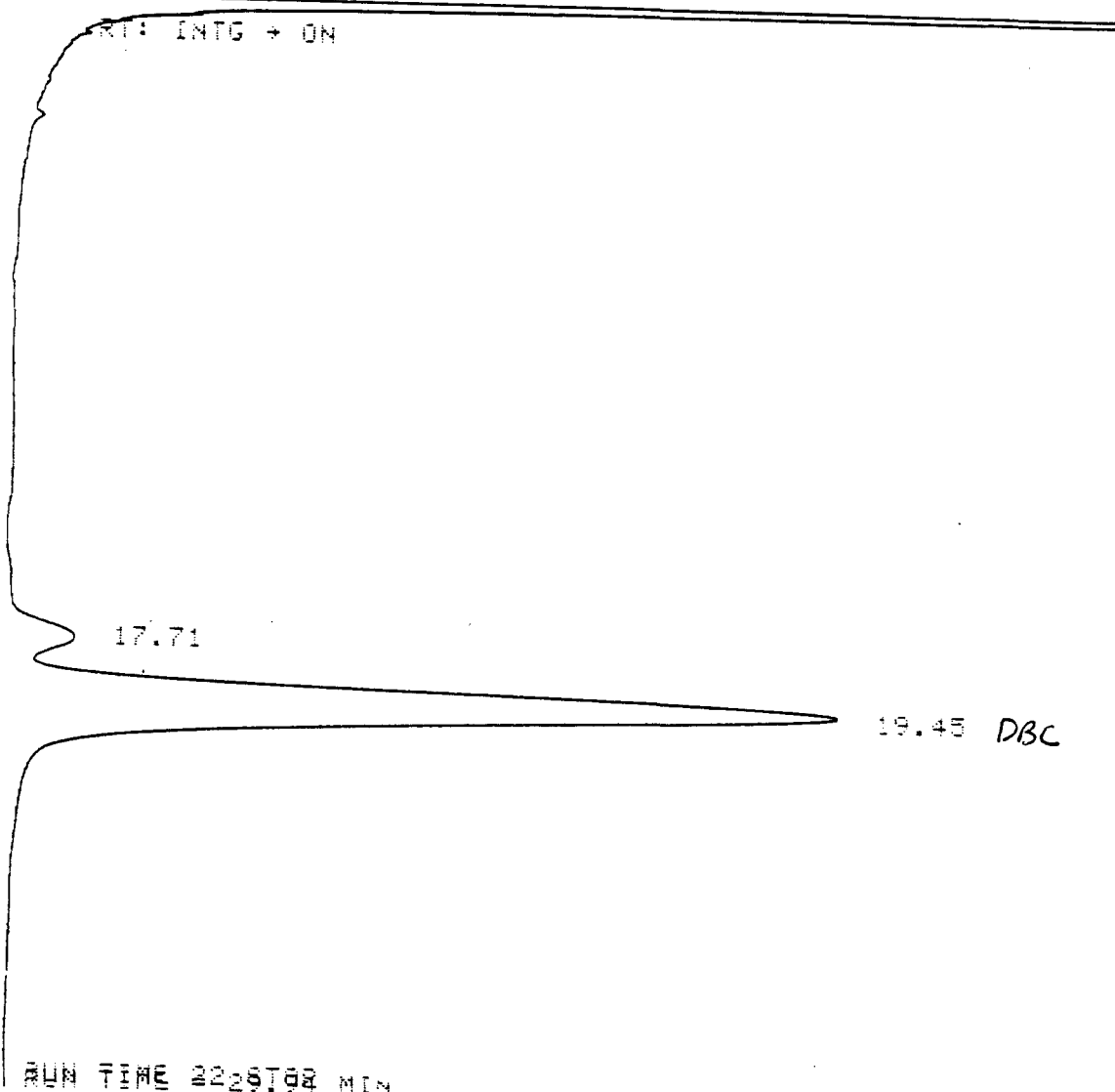
DL: Diluted Out

MS: Matrix Spike Compound added at a level of:

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON



RUN # 1 PESTICIDE ANALYSIS
QUANTITATION RUN

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: BLANK

MANUAL INJECTION @ 08:23 OCT 8, 1986

AREA %

LAB #: 991
CLIENT: SPS
VOL. INJ.: 3 µL

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 17.71 | 10784.20 | BV | 5.936 |
| 19.45 | 170884.00 | VB | 94.064 |

TOTAL AREA = 181668.00
MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

5.06 2,4-DB

RT: STOP RUN

HERBICIDE ANALYSIS

LAB #: 991

SAMPLE ID: BLANK CLIENT: BOEING PETROLEUM

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401 VOL. INJ.: 3 UL

HP 5880A MANUAL INJECTION @ 13:18 SEP 29, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|----------|------|---------|
| 5.06 | 31083.40 | SS | 100.000 |

TOTAL AREA = 31083.40

MULTIPLIER = 1

Boeing Petroleum Services, Inc.
Lab #860991

Asbestos Identification
By Transmission Electron Microscopy

Brazzos Diversion Channel
Raw Water Intake

| | |
|---------------------|----------------|
| Sample #1 | 55.6 fibers/ml |
| Sample #1-Duplicate | 71.3 fibers/ml |

Cavern Brine

| | |
|---------------------|----------------|
| Sample #1 | 26.7 fibers/ml |
| Sample #1-Duplicate | 33.8 fibers/ml |

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES
2445 Florida Avenue
Kenner, Louisiana 70062
(504) 469-0333

METHODS

Inorganic Analyses on Water and Wastewater:

Standard Methods for the Evaluation of Water and Wastewater, APHA, AWWA, WPCF:
16th Edition, 1985.


Soils, Sediments and Hazardous Waste Evaluation Procedures:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846,
U.S.E.P.A. Second Edition Revised April, 1984.

Organic Analyses on Water and Wastewater:

"Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", 40
CFR Part 136, Appendix A., U.S.E.P.A, Amended June 30, 1986.


Other methods if used are referenced with analytical results.



John R. Troest,
Manager of Analytical Services

10/13/86

Date



Thomas E. Orr,
Quality Control Coordinator

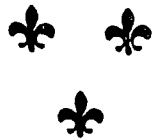
10/20/86

Date



The University of Southwestern Louisiana

Lafayette, Louisiana 70504-4210



College of Sciences
Department of Physics
(318) 231-6691
USL Box 44210

February 2, 1987

Université des Acadiens

Boeing Petroleum Services
Bryon Mound County Road 242
Freeport, TX 77541

Gentlemen:

We have analyzed for asbestos fiber content the sample of brine liquid recently sent to us. The results are listed below.

SAMPLE I.D.:

Cavern 4 Brine
12-22-86
Bryon Mound

SAMPLE DESCRIPTION:

870 ml sample of Brine (tan, murky liquid)

RESULTS:

No asbestos fibers

Other fibers:

$\left\{ \begin{array}{l} \text{Length} < 5 \mu\text{m} \\ \text{Diameter} < 0.5 \mu\text{m} \end{array} \right\} = 2,738 \text{ fibers/ml}$

$\left\{ \begin{array}{l} \text{Length} \geq 5 \mu\text{m} \\ \text{Diameter} < 0.5 \mu\text{m} \end{array} \right\} = 1,369 \text{ fibers/ml}$

Please do not hesitate to call if I can be of further assistance on this matter.

Respectfully submitted,

Davy L. Bernard
Davy L. Bernard, Ph.D.
Asbestos Testing and
Abatement Program

DLB/lit

EIRA ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.


March 6, 1987

Mr. Christopher Upton
Boeing Petroleum Services
850 South Clearview Parkway
New Orleans, LA 70123

Dear Chris:

In reference to the Bryan Mound Project, the detection limits for the asbestos analysis was 8,000 fibers/liter.

Sincerely,


Peter P. Meehan, Jr.
President

PPM:kk

LABORATORY REPORT FOR BRYAN MOUND
TARRY AREA - INITIAL SAMPLING

ACS LABS

ANALYTICAL CONSULTING SERVICES
6251 Corporate Drive • Houston, Texas 77036 • (713) 995-8080

December 16, 1986

Mr. Jim Salinas
BOEING PETROLEUM SERVICES, INC.
850 South Clearview Parkway
New Orleans, La. 70123-3498

Subject: Analysis of three Tar samples.

Re: Lab No. 10609

P.O. # P-009083-0722
Req. No. 2-54628

Analytical Data: Results reported in milligrams per liter.

I. EP TOX METALS: Method SW-846 EP Toxicity Extraction.

| Parameter | NTP- 1 | NTP- 2 | NTP- 3 |
|----------------------|--------|--------|--------|
| Arsenic | <0.01 | <0.01 | <0.01 |
| Antimony | 0.033 | 0.018 | 0.027 |
| Barium | 0.89 | 0.98 | 0.72 |
| Cadmium | <0.01 | <0.01 | <0.01 |
| Chromium | 0.043 | 0.038 | 0.056 |
| Hexavalent Chrome | 0.011 | 0.015 | 0.019 |
| Lead | 0.052 | 0.023 | 0.036 |
| Mercury | 0.27 | 0.053 | 0.024 |
| Nickel | 0.71 | 0.022 | 0.053 |
| Selenium | <0.05 | <0.05 | <0.05 |
| Silver | 0.05 | 0.03 | 0.02 |
| Beryllium | 0.017 | 0.019 | 0.024 |
| Boron | 0.24 | 0.25 | 0.18 |
| Copper | 0.12 | 0.18 | 0.092 |
| Manganese | 2.3 | 2.4 | 1.7 |
| Thallium | <0.05 | <0.05 | <0.05 |

-continued-

BOEING
Lab No. 10609
December 16, 1986
Page -2-

II. PHENOLS:

| Sample I.D. | ppm |
|-------------|------|
| NTP - 1 | 10.4 |
| NTP - 2 | 12.3 |
| NTP - 3 | 8.9 |

III. CYANIDE:

| Sample I.D. | ppm |
|-------------|------|
| NTP - 1 | 0.15 |
| NTP - 2 | 0.22 |
| NTP - 3 | 0.17 |

V. GC/MASS SPEC:

See attached reports - Results reported in micrograms per liter.

Quality Assurance: Samples are analyzed in accordance with EPA, Standard Methods, or ASTM procedures with at least 10% analyzed in duplicate. Serial dilutions and/or process spikes are routinely employed to assure accuracy and precision of the reported data.

ANALYTICAL CONSULTING SERVICES, INC.


Bruce Futrell
Lab Manager

BF/bdm.

BOEING
Lab No. 10609
December 16, 1986
Sample Description: NTP - 1
Pg. 1

GAS CHROMATOGRAPHIC ANALYSIS

| BASE/NEUTRAL EXTRACTABLES | UG / L |
|-----------------------------|--------|
| Bis(2-chloroethyl)ether | < 5.7 |
| 1,3-Dichlorobenzene | < 1.9 |
| 1,4-Dichlorobenzene | < 4.4 |
| 1,2-Dichlorobenzene | < 1.9 |
| Bis(2-chloroisopropyl)ether | < 5.7 |
| Hexachloroethane | < 1.6 |
| N-Nitrosodi-n-propyl amine | < 5.0 |
| Nitrobenzene | < 1.9 |
| Isophorone | < 2.2 |
| Bis(2-chloroethoxy)methane | < 5.3 |
| 1,2,4-Trichlorobenzene | < 1.9 |
| Naphthalene | < 1.6 |
| Hexachlorobutadiene | < 0.9 |
| Hexachlorocyclopentadiene | < 5.0 |
| Acenaphthylene | < 3.5 |
| Dimethyl phthalate | < 1.6 |
| 2,6-Dinitrotoluene | < 1.9 |
| Acenaphthene | < 1.9 |
| 2-Chloronaphthalene | < 1.9 |
| 2,4-Dinitrotoluene | < 5.7 |
| Fluorene | < 1.9 |
| 4-Chlorophenyl phenyl ether | < 4.2 |
| Diethylphthalate | < 1.9 |
| N-Nitrosodiphenylamine | < 1.9 |
| 4-Bromophenyl phenyl ether | < 1.9 |
| Hexachlorobenzene | < 1.9 |
| alpha-BHC | < 5.0 |
| Phenanthrene | 6.0 |
| Anthracene | < 1.9 |
| gamma-BHC | < 3.1 |
| beta-BHC | < 4.2 |
| delta-BHC | < 3.1 |
| Heptachlor | < 1.9 |
| Dibutyl phthalate | 56.2 |
| Aldrin | < 1.9 |
| Heptachlor epoxide | < 2.2 |
| Endosulfan I | < 5.0 |
| Fluoranthene | < 2.2 |
| Pyrene | < 1.9 |
| Endrin | < 5.0 |

-continued-

BOEING

Lab No. 10609

December 16, 1986

Sample Description: NTP - 1

Pg. 2

| | UG | / | L |
|----------------------------|----|---|------|
| Benzidine | < | | 44.0 |
| Endosulfan II | < | | 5.0 |
| Dieldrin | < | | 2.5 |
| 4,4'-DDE | < | | 5.6 |
| 4,4'-DDD | < | | 2.8 |
| Butyl benzyl phthalate | < | | 2.5 |
| Endrin aldehyde | < | | 5.0 |
| Endosulfan sulfate | < | | 5.6 |
| 4,4'-DDT | < | | 4.7 |
| Chrysene | < | | 2.5 |
| Benzo(a)anthracene | < | | 7.8 |
| 3,3'-Dichlorobenzidine | < | | 16.5 |
| Di-n-octylphthalate | < | | 2.5 |
| Bis(2-ethylhexyl)phthalate | < | | 2.5 |
| Benzo(b)fluoranthene | < | | 4.8 |
| Benzo(k)fluoranthene | < | | 2.5 |
| Benzo(a)pyrene | < | | 2.5 |
| Indeno(1,2,3-c,d)pyrene | < | | 3.7 |
| Dibenzo(a,h)anthracene | < | | 2.5 |
| Benzo(ghi)perylene | < | | 4.1 |
| N-Nitrosodimethyl amine | < | | 5.0 |
| Chlordane | < | | 50.0 |
| Toxaphene | < | | 67.0 |
| PCB 1016 | < | | 50.0 |
| PCB 1221 | < | | 30.0 |
| PCB 1232 | < | | 50.0 |
| PCB 1242 | < | | 50.0 |
| PCB 1248 | < | | 50.0 |
| PCB 1254 | < | | 36.0 |
| PCB 1260 | < | | 50.0 |

ACID EXTRACTABLES

| | UG | / | L |
|----------------------------|----|---|------|
| Phenol | < | | 2.7 |
| 2-Chlorophenol | < | | 3.3 |
| 2-Nitrophenol | < | | 3.6 |
| 2,4-Dimethylphenol | < | | 2.7 |
| 2,4-Dichlorophenol | < | | 2.7 |
| 4-Chloro-3-methylphenol | < | | 3.0 |
| 2,4,6-Trichlorophenol | < | | 2.7 |
| 2,4-Dinitrophenol | < | | 42.0 |
| 4-Nitrophenol | < | | 7.2 |
| 2-Methyl-4,6-dinitrophenol | < | | 24.0 |
| Pentachlorophenol | < | | 3.6 |

-continued-

BOEING

Lab No. 10609

December 16, 1986

Sample Description: NTP - 1

Pg. 3

| OTHERS | UG / L |
|---------------------------|--------|
| 2,3,7,8 TCDD | < 5.7 |
| Methylhydroxybenzoate | 9.3 |
| Methyl naphthalene | 2.5 |
| PURGEABLE ORGANICS | UG / L |
| Chloromethane | < 5.0 |
| Bromomethane | < 5.0 |
| Vinyl Chloride | < 5.0 |
| Chloroethane | < 5.0 |
| Methylene chloride | < 2.8 |
| Trichlorofluoromethane | < 5.0 |
| 1,1-Dichloroethene | < 2.8 |
| 1,1-Dichloroethane | < 4.7 |
| trans-1,2-Dichloroethene | < 1.6 |
| Chloroform | < 1.6 |
| 1,2-Dichloroethane | < 2.8 |
| 1,1,1-Trichloroethane | < 3.8 |
| Carbon tetrachloride | < 2.8 |
| Bromodichloromethane | < 2.2 |
| 1,2-Dichloropropane | < 6.0 |
| trans-1,3-Dichloropropene | < 5.0 |
| Trichloroethene | < 1.9 |
| Benzene | < 4.4 |
| Dibromochloromethane | < 3.1 |
| 1,1,2-Trichloroethane | < 5.0 |
| cis-1,3-Dichloropropene | < 5.0 |
| 2-Chloroethylvinyl ether | < 5.0 |
| Bromoform | < 4.7 |
| 1,1,2,2-Tetrachloroethane | < 6.9 |
| Tetrachloroethene | < 4.1 |
| Toluene | < 6.0 |
| Chlorobenzene | 6.4 |
| Ethyl benzene | < 7.2 |
| Acrolein | < 2.0 |
| Acrylonitrile | < 11.9 |

BOEING

Lab No. 10609

December 16, 1986

Sample Description: NTP - 2

Pg. 1

GAS CHROMATOGRAPHIC ANALYSIS

| BASE/NEUTRAL EXTRACTABLES | UG / L |
|-----------------------------|--------|
| Bis(2-chloroethyl)ether | < 5.7 |
| 1,3-Dichlorobenzene | < 1.9 |
| 1,4-Dichlorobenzene | < 4.4 |
| 1,2-Dichlorobenzene | < 1.9 |
| Bis(2-chloroisopropyl)ether | < 5.7 |
| Hexachloroethane | < 1.6 |
| N-Nitrosodi-n-propyl amine | < 5.0 |
| Nitrobenzene | < 1.9 |
| Isophorone | < 2.2 |
| Bis(2-chloroethoxy)methane | < 5.3 |
| 1,2,4-Trichlorobenzene | < 1.9 |
| Naphthalene | < 1.6 |
| Hexachlorobutadiene | < 0.9 |
| Hexachlorocyclopentadiene | < 5.0 |
| Acenaphthylene | < 3.5 |
| Dimethyl phthalate | < 1.6 |
| 2,6-Dinitrotoluene | < 1.9 |
| Acenaphthene | < 1.9 |
| 2-Chloronaphthalene | < 1.9 |
| 2,4-Dinitrotoluene | < 5.7 |
| Fluorene | < 1.9 |
| 4-Chlorophenyl phenyl ether | < 4.2 |
| Diethylphthalate | < 1.9 |
| N-Nitrosodiphenylamine | < 1.9 |
| 4-Bromophenyl phenyl ether | < 1.9 |
| Hexachlorobenzene | < 1.9 |
| alpha-BHC | < 5.0 |
| Phenanthrene | < 6.4 |
| Anthracene | < 1.9 |
| gamma-BHC | < 3.1 |
| beta-BHC | < 4.2 |
| delta-BHC | < 3.1 |
| Heptachlor | < 1.9 |
| Dibutyl phthalate | < 6.8 |
| Aldrin | < 1.9 |
| Heptachlor epoxide | < 2.2 |
| Endosulfan I | < 5.0 |
| Fluoranthene | < 2.2 |
| Pyrene | < 1.9 |
| Endrin | < 5.0 |

-continued-

BOEING

Lab No. 10609

December 16, 1986

Sample Description: NTP - 2

Pg. 2

| | UG | / | L |
|----------------------------|----|---|------|
| Benzidine | < | | 44.0 |
| Endosulfan II | < | | 5.0 |
| Dieldrin | < | | 2.5 |
| 4,4'-DDE | < | | 5.6 |
| 4,4'-DDD | < | | 2.8 |
| Butyl benzyl phthalate | < | | 2.5 |
| Endrin aldehyde | < | | 5.0 |
| Endosulfan sulfate | < | | 5.6 |
| 4,4'-DDT | < | | 4.7 |
| Chrysene | < | | 2.5 |
| Benzo(a)anthracene | < | | 7.8 |
| 3,3'-Dichlorobenzidine | < | | 16.5 |
| Di-n-octylphthalate | < | | 2.5 |
| Bis(2-ethylhexyl)phthalate | < | | 2.5 |
| Benzo(b)fluoranthene | < | | 4.8 |
| Benzo(k)fluoranthene | < | | 2.5 |
| Benzo(a)pyrene | < | | 2.5 |
| Indeno(1,2,3-c,d)pyrene | < | | 3.7 |
| Dibenzo(a,h)anthracene | < | | 2.5 |
| Benzo(ghi)perylene | < | | 4.1 |
| N-Nitrosodimethyl amine | < | | 5.0 |
| Chlordane | < | | 50.0 |
| Toxaphene | < | | 86.7 |
| PCB 1016 | < | | 50.0 |
| PCB 1221 | < | | 30.0 |
| PCB 1232 | < | | 50.0 |
| PCB 1242 | < | | 50.0 |
| PCB 1248 | < | | 50.0 |
| PCB 1254 | < | | 36.0 |
| PCB 1260 | < | | 50.0 |

ACID EXTRACTABLES

| | UG | / | L |
|----------------------------|----|---|------|
| Phenol | < | | 2.7 |
| 2-Chlorophenol | < | | 3.3 |
| 2-Nitrophenol | < | | 3.6 |
| 2,4-Dimethylphenol | < | | 2.7 |
| 2,4-Dichlorophenol | < | | 2.7 |
| 4-Chloro-3-methylphenol | < | | 3.0 |
| 2,4,6-Trichlorophenol | < | | 2.7 |
| 2,4-Dinitrophenol | < | | 42.0 |
| 4-Nitrophenol | < | | 2.4 |
| 2-Methyl-4,6-dinitrophenol | < | | 24.0 |
| Pentachlorophenol | < | | 3.6 |

-continued-

BOEING
Lab No. 10609
December 16, 1986
Sample Description: NTP - 2
Pg. 3

| OTHERS | UG | / | L |
|--------------------|----|---|-----|
| 2,3,7,8 TCDD | < | | 7.3 |
| Methyl naphthalene | | | 2.5 |

| PURGEABLE ORGANICS | UG | / | L |
|---------------------------|----|---|------|
| Chloromethane | < | | 5.0 |
| Bromomethane | < | | 5.0 |
| Vinyl Chloride | < | | 5.0 |
| Chloroethane | | | 8.7 |
| Methylene chloride | < | | 2.8 |
| Trichlorofluoromethane | < | | 5.0 |
| 1,1-Dichloroethene | < | | 2.8 |
| 1,1-Dichloroethane | < | | 4.7 |
| trans-1,2-Dichloroethene | < | | 1.6 |
| Chloroform | < | | 1.6 |
| 1,2-Dichloroethane | < | | 2.8 |
| 1,1,1-Trichloroethane | < | | 3.8 |
| Carbon tetrachloride | < | | 2.8 |
| Bromodichloromethane | < | | 2.2 |
| 1,2-Dichloropropane | < | | 6.0 |
| trans-1,3-Dichloropropene | < | | 5.0 |
| Trichloroethene | < | | 1.9 |
| Benzene | < | | 4.4 |
| Dibromochloromethane | < | | 3.1 |
| 1,1,2-Trichloroethane | < | | 5.0 |
| cis-1,3-Dichloroporpene | < | | 5.0 |
| 2-Chloroethylvinyl ether | < | | 5.0 |
| Bromoform | < | | 4.7 |
| 1,1,2,2-Tetrachloroethane | < | | 6.9 |
| Tetrachloroethene | < | | 4.1 |
| Toluene | < | | 6.0 |
| Chlorobenzene | | | 7.5 |
| Ethyl benzene | < | | 7.2 |
| Acrolein | < | | 2.0 |
| Acrylonitrile | < | | 10.0 |

BOEING

Lab No. 10609

December 16, 1986

Sample Description: NTP - 3

Pg. 1

GAS CHROMATOGRAPHIC ANALYSIS

| BASE/NEUTRAL EXTRACTABLES | UG | / | L |
|-----------------------------|----|---|-----|
| Bis(2-chloroethyl)ether | < | | 5.7 |
| 1,3-Dichlorobenzene | < | | 1.9 |
| 1,4-Dichlorobenzene | < | | 4.4 |
| 1,2-Dichlorobenzene | < | | 1.9 |
| Bis(2-chloroisopropyl)ether | < | | 5.7 |
| Hexachloroethane | < | | 1.6 |
| N-Nitrosodi-n-propyl amine | < | | 5.0 |
| Nitrobenzene | < | | 1.9 |
| Isophorone | < | | 2.2 |
| Bis(2-chloroethoxy)methane | < | | 5.3 |
| 1,2,4-Trichlorobenzene | < | | 1.9 |
| Naphthalene | < | | 1.6 |
| Hexachlorobutadiene | < | | 0.9 |
| Hexachlorocyclopentadiene | < | | 5.0 |
| Acenaphthylene | < | | 3.5 |
| Dimethyl phthalate | < | | 1.6 |
| 2,6-Dinitrotoluene | < | | 1.9 |
| Acenaphthene | < | | 1.9 |
| 2-Chloronaphthalene | < | | 1.9 |
| 2,4-Dinitrotoluene | < | | 5.7 |
| Fluorene | < | | 1.9 |
| 4-Chlorophenyl phenyl ether | < | | 4.2 |
| Diethylphthalate | < | | 1.9 |
| N-Nitrosodiphenylamine | < | | 1.9 |
| 4-Bromophenyl phenyl ether | < | | 1.9 |
| Hexachlorobenzene | < | | 1.9 |
| alpha-BHC | < | | 5.0 |
| Phenanthrene | | | 7.5 |
| Anthracene | < | | 1.9 |
| gamma-BHC | < | | 3.1 |
| beta-BHC | < | | 4.2 |
| delta-BHC | < | | 3.1 |
| Heptachlor | < | | 1.9 |
| Dibutyl phthalate | < | | 2.5 |
| Aldrin | < | | 1.9 |
| Heptachlor epoxide | < | | 2.2 |
| Endosulfan I | < | | 5.0 |
| Fluoranthene | < | | 2.2 |
| Pyrene | < | | 1.9 |
| Endrin | < | | 5.0 |

-continued-

BOEING

Lab No. 10609

December 16, 1986

Sample Description: NTP - 3

Pg. 2

| | UG | / | L |
|----------------------------|----|---|------|
| Benzidine | < | | 44.0 |
| Endosulfan II | < | | 5.0 |
| Dieldrin | < | | 2.5 |
| 4,4'-DDE | < | | 5.6 |
| 4,4'-DDD | < | | 2.8 |
| Butyl benzyl phthalate | < | | 2.5 |
| Endrin aldehyde | < | | 5.0 |
| Endosulfan sulfate | < | | 5.6 |
| 4,4'-DDT | < | | 4.7 |
| Chrysene | < | | 2.5 |
| Benzo(a)anthracene | < | | 7.8 |
| 3,3'-Dichlorobenzidine | < | | 16.5 |
| Di-n-octylphthalate | < | | 2.5 |
| Bis(2-ethylhexyl)phthalate | < | | 2.5 |
| Benzo(b)fluoranthene | < | | 4.8 |
| Benzo(k)fluoranthene | < | | 2.5 |
| Benzo(a)pyrene | < | | 2.5 |
| Indeno(1,2,3-c,d)pyrene | < | | 3.7 |
| Dibenzo(a,h)anthracene | < | | 2.5 |
| Benzo(ghi)perylene | < | | 4.1 |
| N-Nitrosodimethyl amine | < | | 5.0 |
| Chlordane | < | | 50.0 |
| Toxaphene | < | | 95.0 |
| PCB 1016 | < | | 50.0 |
| PCB 1221 | < | | 30.0 |
| PCB 1232 | < | | 50.0 |
| PCB 1242 | < | | 50.0 |
| PCB 1248 | < | | 50.0 |
| PCB 1254 | < | | 36.0 |
| PCB 1260 | < | | 50.0 |

ACID EXTRACTABLES

| | UG | / | L |
|----------------------------|----|---|------|
| Phenol | < | | 2.7 |
| 2-Chlorophenol | < | | 3.3 |
| 2-Nitrophenol | < | | 3.6 |
| 2,4-Dimethylphenol | < | | 2.7 |
| 2,4-Dichlorophenol | < | | 2.7 |
| 4-Chloro-3-methylphenol | < | | 3.0 |
| 2,4,6-Trichlorophenol | < | | 2.7 |
| 2,4-Dinitrophenol | < | | 42.0 |
| 4-Nitrophenol | < | | 2.4 |
| 2-Methyl-4,6-dinitrophenol | < | | 24.0 |
| Pentachlorophenol | < | | 3.6 |

-continued-

BOEING

Lab No. 10609

December 16, 1986

Sample Description: NTP - 3

Pg. 3

OTHERS

UG / L

2,3,7,8 TCDD

< 8.0

Methyl naphthalene

2.1

PURGEABLE ORGANICS

UG / L

Chloromethane

< 5.0

Bromomethane

< 5.0

Vinyl Chloride

< 5.0

Chloroethane

< 5.0

Methylene chloride

< 2.8

Trichlorofluoromethane

< 5.0

1,1-Dichloroethene

< 2.8

1,1-Dichloroethane

< 4.7

trans-1,2-Dichloroethene

< 1.6

Chloroform

< 1.6

1,2-Dichloroethane

< 2.8

1,1,1-Trichloroethane

< 3.8

Carbon tetrachloride

< 2.8

Bromodichloromethane

< 2.2

1,2-Dichloropropane

< 6.0

trans-1,3-Dichloropropene

< 5.0

Trichloroethene

< 1.9

Benzene

< 4.4

Dibromochloromethane

< 3.1

1,1,2-Trichloroethane

< 5.0

cis-1,3-Dichloropropene

< 5.0

2-Chloroethylvinyl ether

< 5.0

Bromoform

< 4.7

1,1,2,2-Tetrachloroethane

< 6.9

Tetrachloroethene

< 4.1

Toluene

< 6.0

Chlorobenzene

< 6.0

Ethyl benzene

< 7.2

Acrolein

< 2.0

Acrylonitrile

< 10.0

LABORATORY REPORT FOR BRYAN MOUND TARRY AREA
(SECOND SAMPLE SET)

ACS LABS
ANALYTICAL CONSULTING SERVICES
6251 Corporate Drive • Houston, Texas 77036 • (713) 995-8080

April 8, 1987

Mr. Chris Upton
BOEING PETROLEUM SERVICES
850 S. Clearview Parkway
New Orleans, La. 70123

Subject: Sampling and Analysis of the Tar Pit by Cavern 101.
Bryan Mound SPR Site - Freeport, Texas

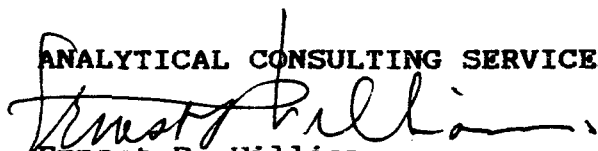
Re: Lab No. 11251

Contract # P-010459-0912

Analysis of ten samples in accordance with above referenced contract.

Please attached reports.

ANALYTICAL CONSULTING SERVICES, INC.


Ernest P. Williams
Lab Director

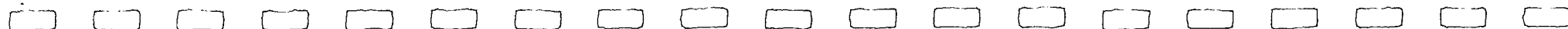
EPW/bdm.
Encl.

Mr. C. Upton
BOEING
Lab No. 11251
Contract # P-010459-0912
April 8, 1987
Page -2-

PART A: EP Toxicity EPA Method 1310 SW-846.

ANALYTICAL DATA: Results reported in micrograms per liter (ppb) extracted basis.

| Parameter | 114-1A | | 115-2A | 116-3A | 117-4A | 118-5A | 119-6A | 120-7A | 121-8A | 122-9A | 123-10A | Method Detect Limit |
|--------------------|--------|-----------|--------|--------|--------|--------|--------|--------|--------|--------|---------|------------------------|
| | 114-1A | Duplicate | | | | | | | | | | |
| Arsenic | 25 | 28 | <10 | 13 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 |
| Barium | <10 | <10 | 12 | <10 | <10 | 15 | 12 | 12 | <10 | 150 | 44 | 10 |
| Cadmium | <1 | <1 | <1 | <1 | <1 | <1 | 3 | <1 | <1 | <1 | <1 | 1 |
| Chromium | <10 | <10 | <10 | <10 | <10 | <10 | 16 | <10 | <10 | <10 | <10 | 10 |
| Lead | <10 | <10 | <10 | <10 | <10 | <10 | 40 | <10 | <10 | <10 | <10 | 10 |
| Mercury | 39.5 | 36 | 8.6 | 2.4 | <2 | <2 | <2 | 32.8 | 18 | 2.3 | <2 | 2 |
| Selenium | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | 20 |
| Silver | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | <2 | 2 |
| Endrin | <20 | --- | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | 20 |
| Lindane | <20 | --- | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | 20 |
| Methoxychlor | <10 | --- | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 |
| Toxaphene | <20 | --- | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | <20 | 20 |
| 2,4-D,2,4, 5-TP | <10 | --- | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 10 |
| Silvex | <100 | --- | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | <100 | 100 |



PART B: EPA Method 3050 SW 846. Digestate Samples

ANALYTICAL DATA: Results reported in milligrams per kilogram sample basis.

[illegible]

[illegible]

PART C: GC/MS Methods 8240, 8250, 8270.

II. Base/Neutral Extractables (GC/MS Method 625)

[illegible]

PART C: GC/MS Methods 8240, 8250, 8270.

II. Base/Neutral Extractables (GC/MS Method 625)

[illegible]

BOEING

Lab No. 11251

Contract # P-010459-0912

April 3, 1987

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PART C: GC/MS Methods 8240, 8250, 8270.

II. Base/Neutral Extractables (GC/MS Method 625)

[illegible]

III. Acid Extractables

[illegible]

LABORATORY REPORT FOR SULPHUR MINES

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES
2445 Florida Avenue
Kenner, Louisiana 70062
(504) 469-0333

LABORATORY REPORT

Prepared For: Boeing Petroleum Service, Inc.

Sample Description: 20 Solids

Laboratory Number: 86099917
Date Received: 09/29/86

Job Number: Not Supplied
Sampled By: Client

Analyses Requested: Herbicides, Pesticides and 8 EP Toxicity Metals

RESULTS

#3 Blank

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | BDL | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.06 | 0.05 |
| Mercury | 0.0361 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

#4 Blank

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.13 | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.07 | 0.05 |
| Mercury | 0.0373 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

-continued-

WL PD Lab Blank

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | BDL | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0010 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 3 A

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | 0.004 | 0.002 |
| Barium | 0.60 | 0.1 |
| Cadmium | 0.005 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.06 | 0.05 |
| Mercury | 0.0006 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 3 B

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | 0.005 | 0.002 |
| Barium | 0.77 | 0.1 |
| Cadmium | 0.005 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.06 | 0.05 |
| Mercury | 0.0014 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 3 C

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.68 | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0318 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 3 D

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.36 | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | BDL | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 3 E

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.38 | 0.1 |
| Cadmium | 0.005 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0012 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 3 B

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.30 | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0006 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 3 G

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.35 | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0018 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 3 H

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.28 | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0008 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 3 I

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.46 | 0.1 |
| Cadmium | 0.005 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0012 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 3 J

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.58 | 0.1 |
| Cadmium | 0.007 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.05 | 0.05 |
| Mercury | 0.0008 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.01 | 0.01 |

WL PD 3 J-Duplicate

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.50 | 0.1 |
| Cadmium | 0.008 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.06 | 0.05 |
| Mercury | 0.0012 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.01 | 0.01 |

WL PD 4 K

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.42 | 0.1 |
| Cadmium | 0.006 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0370 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 4 L

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.66 | 0.1 |
| Cadmium | 0.008 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.05 | 0.05 |
| Mercury | 0.0030 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.01 | 0.01 |

WL PD 4 L-Duplicate

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.56 | 0.1 |
| Cadmium | 0.005 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0024 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.01 | 0.01 |

WL PD 4 M

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.88 | 0.1 |
| Cadmium | 0.019 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.12 | 0.05 |
| Mercury | 0.0018 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 4 N

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.56 | 0.1 |
| Cadmium | 0.011 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0012 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 4 O

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | 0.004 | 0.002 |
| Barium | 0.67 | 0.1 |
| Cadmium | 0.009 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.08 | 0.05 |
| Mercury | 0.0010 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.01 | 0.01 |

WL PD 4 P

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.55 | 0.1 |
| Cadmium | BDL | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0018 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 4 Q

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.55 | 0.1 |
| Cadmium | 0.005 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0010 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.01 | 0.01 |



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

WL PD 4 R

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.59 | 0.1 |
| Cadmium | 0.008 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0020 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

WL PD 3 S

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.60 | 0.1 |
| Cadmium | 0.019 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | 0.13 | 0.05 |
| Mercury | 0.0014 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | 0.02 | 0.01 |

WL PD 4 T

| <u>Test</u> | <u>Concentration (mg/l)</u> | <u>RDL (mg/l)</u> |
|-------------|-----------------------------|-------------------|
| Arsenic | BDL | 0.002 |
| Barium | 0.47 | 0.1 |
| Cadmium | 0.009 | 0.005 |
| Chromium | BDL | 0.05 |
| Lead | BDL | 0.05 |
| Mercury | 0.0030 | 0.0002 |
| Selenium | BDL | 0.002 |
| Silver | BDL | 0.01 |

RDL: Required Detction Limit
BDL: Below Detection Limit

Client: Boeing Petroleum
Sample: Section A

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 63

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 93

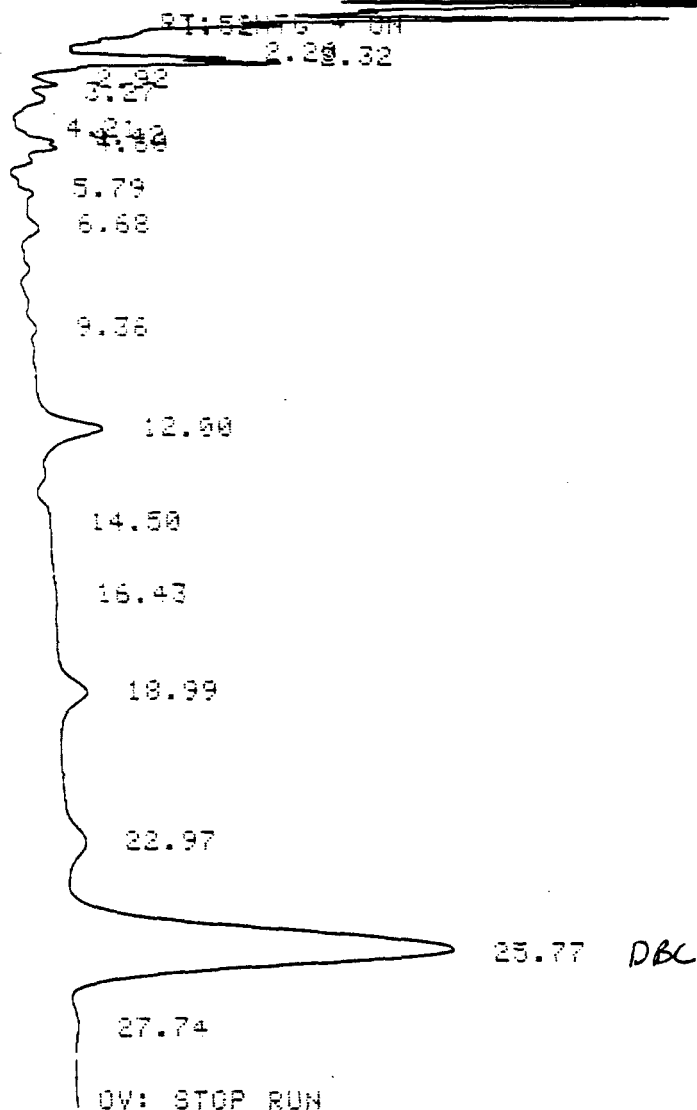
RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

EIRA

ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

READY FOR INJECTION

RT: INTG + OFF



RUN # 2

PESTICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 AL

SAMPLE ID: SECTION A

INP 58800 MANUAL INJECTION @ 10:28 OCT 20, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|----------|------|--------|
| 1.52 | 721.69 | BP | 0.264 |
| 2.20 | 7238.67 | PV | 2.640 |
| 2.32 | 10961.50 | VV | 4.011 |
| 2.92 | 1895.73 | PV | 0.694 |
| 3.27 | 3278.14 | VP | 1.199 |
| 4.21 | 794.28 | VV | 0.291 |
| 4.42 | 2960.89 | VV | 1.083 |
| 4.60 | 3315.54 | VV | 1.213 |
| 5.79 | 821.84 | PB | 0.301 |
| 6.68 | 2151.41 | BP | 0.787 |
| 9.36 | 2013.55 | VV | 0.737 |
| 12.00 | 23735.20 | VV | 8.684 |
| 14.50 | 2670.82 | PV | 0.977 |

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.61 2,4-DG

RT: STOP RUN QV: STOP RUN RUN # 3

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION A

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 15:02 OCT 23, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.61 | 149709.00 | SS | 100.000 |

TOTAL AREA = 149709.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section B

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchlorendate Recovery 63

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 112

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG → OFF

RT: INTG → ON

2.20

3.38

4.41

4.95

5.77

6.69

7.38

7.80

12.01

19.01

22.96

25.80 DBC

OV: STOP RUN

RUN # 3

PESTICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 AL

SAMPLE ID: SECTION B

5880A MANUAL INJECTION @ 10:59 OCT 20, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 2.20 | 1637.89 | PV | 0.747 |
| 2.32 | 2859.70 | VV | 1.304 |
| 3.38 | 1389.68 | PV | 0.634 |
| 4.41 | 1345.73 | PV | 0.613 |
| 4.60 | 1372.23 | VV | 0.626 |
| 4.95 | 1171.81 | VP | 0.534 |
| 5.77 | 1820.16 | PV | 0.830 |
| 6.69 | 3993.44 | VV | 1.821 |
| 7.38 | 877.23 | VV | 0.400 |
| 7.80 | 1094.63 | VB | 0.499 |
| 12.01 | 6125.93 | VP | 2.793 |
| 19.01 | 3138.91 | BB | 1.431 |
| 22.96 | 13882.60 | BV | 6.329 |
| 25.80 | 178644.00 | VP | 81.441 |

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.61 2,4-DB

RUN # 6

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION B

VOL. INJ.: 3 µL

MANUAL INJECTION @ 15:33 OCT 23, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.61 | 180356.00 | BB | 100.000 |

TOTAL AREA = 180356.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section C

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchlorendate Recovery 75

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 96

RDL: Required Detection Limit

BDL: Below Detection Limit

** : Below Report Limit, but Detected

B: Detected in Blank

*** DL: Diluted Out

INTG = ON

2.20

3.37

4.61

5.78

6.68

7.37

7.79

8.74

9.36

9.91

12.03

14.37

18.98

22.95

25.81 DBL

OV: STOP RUN

RUN # 4

PESTICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: SPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 AL

SAMPLE ID: SECTION C

HP 5880A MANUAL INJECTION @ 11:31 OCT 20, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 2.20 | 1969.83 | PV | 0.683 |
| 2.32 | 3302.72 | VV | 1.146 |
| 3.37 | 1869.58 | PV | 0.648 |
| 4.61 | 4957.06 | VV | 1.719 |
| 4.95 | 2678.47 | VV | 0.929 |
| 5.78 | 4500.70 | VV | 1.561 |
| 6.68 | 9870.73 | VV | 3.424 |
| 7.37 | 3088.03 | VV | 1.071 |
| 7.79 | 5176.18 | VV | 1.795 |
| 8.74 | 4836.11 | VV | 1.677 |
| 9.36 | 5142.07 | VV | 1.783 |
| 9.91 | 2654.18 | VV | 0.921 |
| 12.03 | 10149.60 | VB | 3.520 |
| 14.37 | 819.72 | PV | 0.284 |
| 18.98 | 7666.04 | SB | 2.659 |
| 22.95 | 8482.67 | PP | 2.942 |
| 25.81 | 211157.00 | PB | 73.237 |

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.60 2,4-D

RUN # 13

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION C

VOL. INJ.: 3 µL

INP 5880R MANUAL INJECTION @ 14:25 OCT 24, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.60 | 230572.00 | SB | 100.000 |

TOTAL AREA = 230572.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section D

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchlorodate Recovery 71

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 90

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON
22131

4.60

5.75

6.68

7.39

7.80

9.36

11.99

18.96

22.97

25.80 DBC

OV: STOP RUN

RUN # 5

PESTICIDE ANALYSIS

QUANTITATION RUN

LAB #: 99917

CLIENT: BPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 µL

SAMPLE ID: SECTION D

HP 5880A MANUAL INJECTION @ 12:02 OCT 20, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|---------|------|--------|
| 2.19 | 1762.16 | PV | 0.745 |
| 2.31 | 2940.46 | VV | 1.243 |
| 4.60 | 528.24 | BV | 0.223 |
| 4.92 | 687.86 | VB | 0.291 |
| 5.75 | 2040.17 | BV | 0.863 |
| 6.68 | 5301.49 | VV | 2.241 |
| 7.39 | 1555.70 | VV | 0.659 |
| 7.80 | 2515.54 | VV | 1.063 |
| 9.36 | 2374.12 | VV | 1.004 |
| 11.99 | 3930.16 | BP | 1.662 |
| 18.96 | 5111.05 | BB | 2.161 |
| 22.97 | 8292.10 | BV | 3.506 |

READY FOR INJECTION

RT: INTG → OFF

RT: INTG → ON

4.58 2,4-DB

RUN # 16 HERBICIDE ANALYSIS
 QUANTITATION RUN
 COLUMN: 6 FT X 4 MM 3% SP-2250
SAMPLE ID: SECTION ~~2~~D

LAB #: 99917
CLIENT: BPS
VOL. INJ.: 3 µL

HP 5890A MANUAL INJECTION @ 14:51 OCT 24, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.58 | 216182.00 | BB | 100.000 |

TOTAL AREA = 216182.00
MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section E

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchlorendate Recovery 73

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 91

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON
22.32

4.60

5.78

6.66

9.36

12.00

18.96

22.95

25.80 DBC

RUN # 6

PESTICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 µL

SAMPLE ID: SECTION E

HP 5880A MANUAL INJECTION @ 12:33 OCT 20, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 2.19 | 1864.51 | PV | 0.767 |
| 2.32 | 3078.02 | VV | 1.266 |
| 4.60 | 490.35 | BV | 0.202 |
| 5.78 | 1855.14 | BV | 0.763 |
| 6.66 | 4835.15 | VV | 1.989 |
| 9.36 | 1908.01 | VV | 0.782 |
| 12.00 | 4157.64 | BP | 1.710 |
| 18.96 | 6639.10 | BS | 2.731 |
| 22.95 | 11567.60 | BV | 4.759 |
| 25.80 | 206692.00 | VB | 85.031 |

TOTAL AREA = 243079.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.64 2,4-DB

RT: STOP RUN OV: STOP RUN RUN # 8

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

VOL. INJ.: 3 µL

SAMPLE ID: SECTION E

INP 5880A MANUAL INJECTION @ 10:42 OCT 23, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.64 | 159496.00 | BB | 100.000 |

TOTAL AREA = 159496.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section F

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 75

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 28

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG + OFF

RT: 25.78 + ON

3.84
4.43

5.77

8.34

10.43
11.25
11.94

14.36

17.97
18.96

22.95

25.78 DDC

OV: STOP RUN

RUN # 7

PESTICIDE ANALYSIS
QUANTITATION RUN

LAB #: 99917

CLIENT: SPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 µL

SAMPLE ID: SECTION F

INP 5880A MANUAL INJECTION @ 13:04 OCT 20, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|---------|------|--------|
| 1.77 | 1800.17 | BP | 0.616 |
| 2.05 | 2916.74 | PV | 0.999 |
| 2.19 | 1719.56 | VV | 0.589 |
| 2.31 | 2677.50 | VV | 0.917 |
| 3.84 | 1281.80 | BP | 0.439 |
| 4.43 | 2646.32 | PV | 0.906 |
| 4.63 | 3028.85 | VP | 1.037 |
| 5.77 | 452.96 | SV | 0.155 |
| 6.17 | 6052.32 | VV | 2.072 |
| 8.34 | 1201.05 | SB | 0.411 |
| 10.43 | 1454.24 | SH | 0.498 |
| 11.25 | 4982.21 | HH | 1.706 |
| 11.94 | 6147.46 | HH | 2.105 |
| 14.36 | 4936.09 | GU | 1.660 |

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.61 2,4-DB

RT: STOP RUN

RUN # 7 HERBICIDE ANALYSIS
 QUANTITATION RUN
 COLUMN: 6 FT X 4 MM 3% SP-2250
SAMPLE ID: SECTION F

LAB #: 99917
CLIENT: SPS
VOL. INJ.: 3 µL

[hp] 5880A MANUAL INJECTION @ 15:40 OCT 23, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|------|----------|------|---------|
| 4.61 | 44582.20 | 88 | 100.000 |

TOTAL AREA = 44582.20
MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section G

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchlorendate Recovery 64

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 60

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

3.85
4.43
5.75
6.18
7.36
8.33

10.43
11.25
11.94

14.38

17.99
18.98

22.95

25.79 DBC

RUN # 8

PESTICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 AL

SAMPLE ID: SECTION G

[AP] 5880A MANUAL INJECTION @ 13:37 OCT 20, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|---------|------|--------|
| 1.51 | 330.53 | BP | 0.138 |
| 1.77 | 1770.74 | PP | 0.740 |
| 2.05 | 2950.17 | PV | 1.232 |
| 2.19 | 1523.13 | VV | 0.636 |
| 2.32 | 2503.30 | VV | 1.045 |
| 3.85 | 627.93 | BP | 0.262 |
| 4.43 | 2464.64 | PV | 1.029 |
| 4.63 | 2998.80 | VB | 1.252 |
| 5.75 | 1476.70 | SV | 0.617 |
| 6.18 | 7791.94 | VV | 3.254 |
| 7.36 | 1613.92 | VV | 0.674 |
| 8.33 | 1191.50 | BB | 0.498 |
| 10.43 | 1363.44 | SV | 0.569 |

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.58

24-DB

RT: STOP RUN OV: STOP RUN

RUN # 19 HERBICIDE ANALYSIS LAB #: 99917
 QUANTITATION RUN CLIENT: BPS
 COLUMN: 6 FT X 4 MM 3% SP-2250
SAMPLE ID: SECTION G VOL. INJ.: 3 µL

INP] 58800 MANUAL INJECTION @ 15:15 OCT 24, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.58 | 144022.00 | 88 | 100.000 |

TOTAL AREA = 144022.00
MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section H

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 64

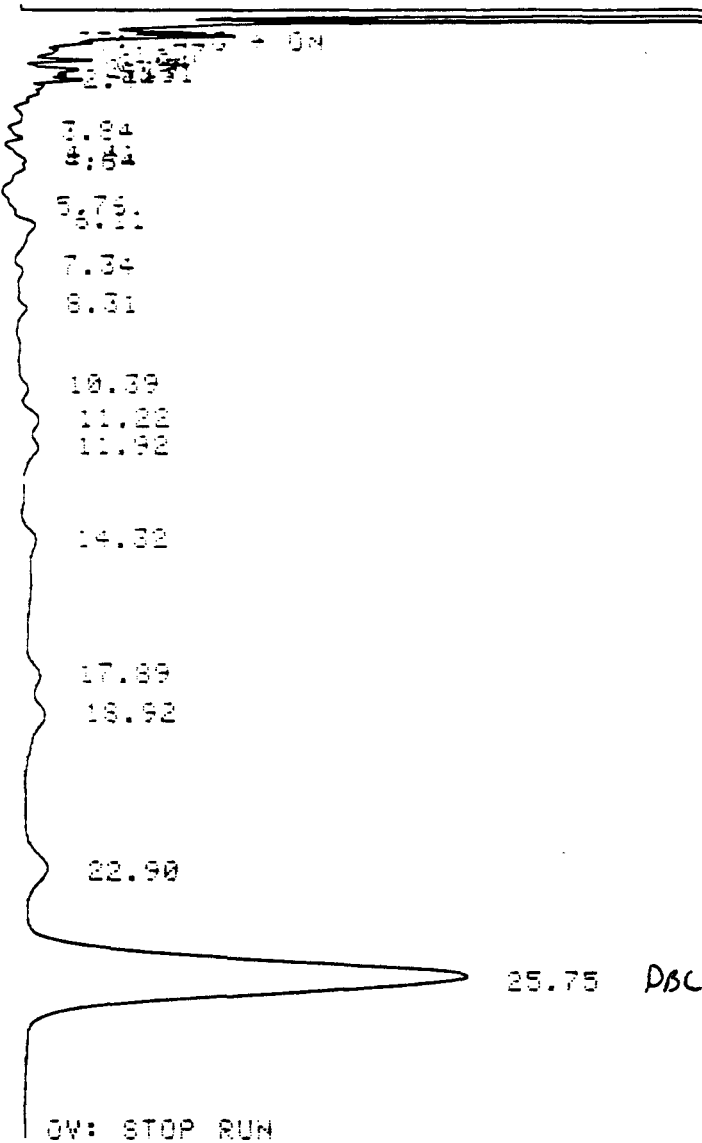
HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 43

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out



RUN # 12 PESTICIDE ANALYSIS LAB #: 99917
 QUANTITATION RUN CLIENT: SPS
 COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401 VOL. INJ.: 3 µL
 SAMPLE ID: SECTION H
 [SP] 58800 MANUAL INJECTION @ 16:00 OCT 20, 1986
 AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.77 | 3237.99 | VV | 1.360 |
| 2.04 | 4197.16 | VV | 1.725 |
| 2.19 | 2202.32 | VV | 0.925 |
| 2.31 | 3232.41 | VV | 1.357 |
| 2.44 | 2029.54 | VV | 0.852 |
| 4.41 | 2028.88 | PV | 0.852 |
| 6.11 | 6784.17 | VV | 2.849 |
| 11.22 | 4771.25 | VV | 2.003 |
| 11.92 | 5233.84 | VV | 2.198 |
| 14.32 | 4361.10 | PV | 1.831 |
| 17.89 | 3726.86 | SV | 1.565 |
| 18.92 | 6925.06 | VB | 2.908 |
| 22.90 | 8295.64 | PV | 3.483 |
| 25.75 | 181212.00 | VB | 76.092 |

TOTAL AREA = 238148.00

READY FOR INJECTION

RT: INTEG + OFF

RT: INTEG + ON

4.64

2,4-DB

RUN # 14 HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: SPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION H

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 14:34 OCT 24, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.64 | 103030.00 | SS | 100.000 |

TOTAL AREA = 103030.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section I

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 81

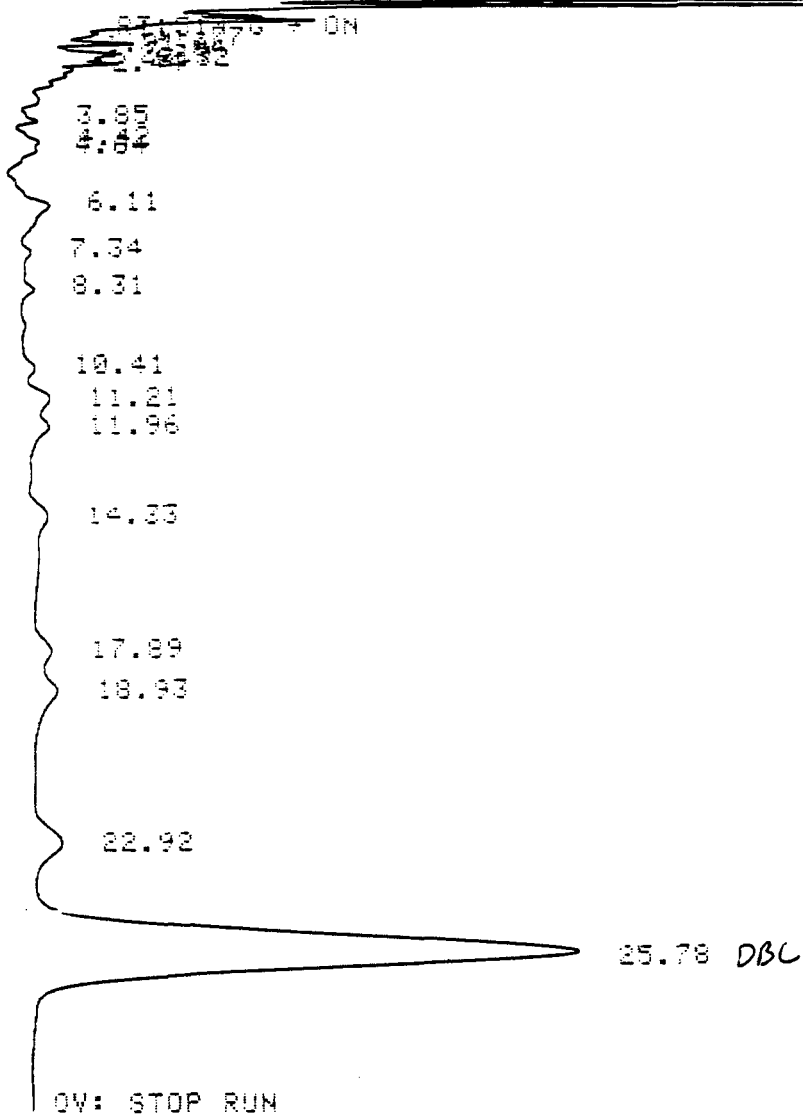
HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 93

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out



RUN # 11 PESTICIDE ANALYSIS
 QUANTITATION RUN
 COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401
 SAMPLE ID: SECTION I
 [HP] 5880A MANUAL INJECTION @ 15:21 OCT 20, 1986
 AREA %

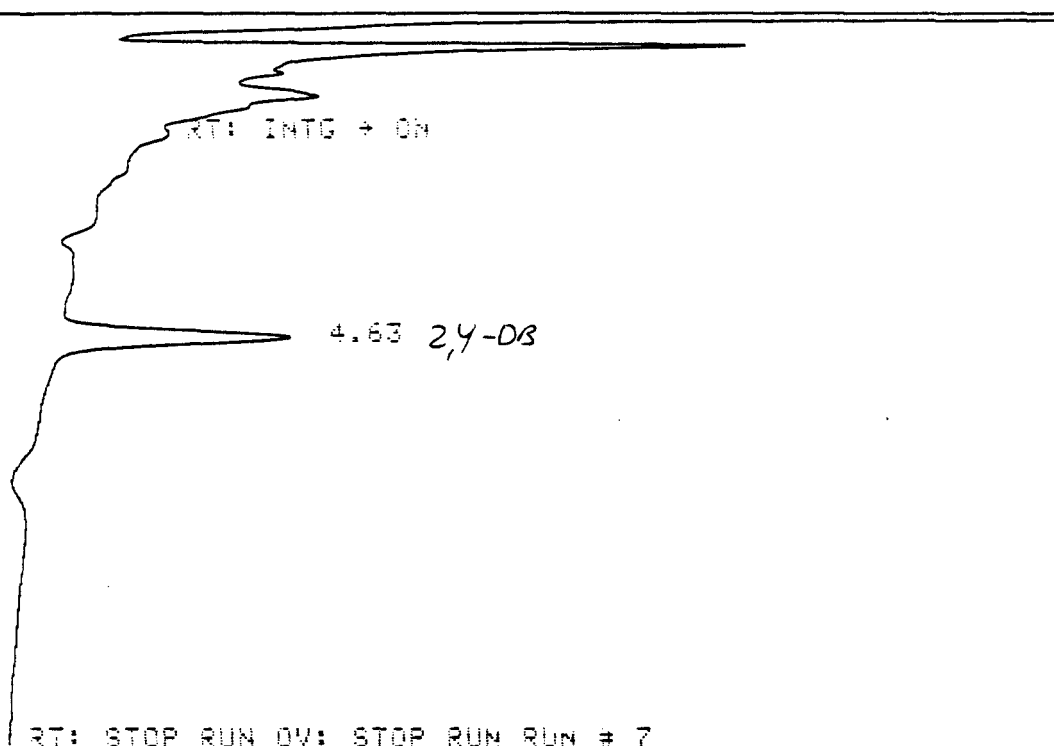
LAB #: 99917
 CLIENT: BPS
 VOL. INJ.: 3 µL

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.77 | 2229.53 | PP | 0.756 |
| 2.04 | 3706.63 | VV | 1.256 |
| 2.32 | 3041.02 | VV | 1.031 |
| 4.42 | 3034.15 | PV | 1.029 |
| 4.64 | 3473.76 | VP | 1.177 |
| 6.11 | 10230.60 | VV | 3.467 |
| 11.21 | 5918.39 | VV | 2.006 |
| 11.96 | 6294.85 | VV | 2.133 |
| 14.33 | 5885.44 | VV | 1.995 |
| 17.89 | 4748.82 | BV | 1.609 |
| 18.93 | 6238.59 | VB | 2.792 |
| 22.92 | 9551.33 | BV | 3.237 |
| 25.78 | 228714.00 | VB | 77.512 |

TOTAL AREA = 295067.00
 MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF



HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

VOL. INJ.: 3 µL

SAMPLE ID: SECTION I

【hp】 5880A MANUAL INJECTION @ 10:14 OCT 23, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.63 | 162481.00 | BB | 100.000 |

TOTAL AREA = 162481.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section J

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchlorendate Recovery 75

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 96

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

RUN TIME = 19.64 MIN

19.00

22.93

25.79 DBL

OV: STOP RUN

RUN # 14 PESTICIDE ANALYSIS
QUANTITATION RUN

LAB #: 99917

CLIENT: BPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 AL

SAMPLE ID: SECTION J

[AP] 58808 MANUAL INJECTION @ 07:58 OCT 21, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 19.00 | 4818.75 | BP | 2.135 |
| 22.93 | 9321.99 | BP | 4.130 |
| 25.79 | 211590.00 | PS | 93.736 |

TOTAL AREA = 225730.00

MULTIPLIER = 1

OTT

READY FOR INJECTION

RT: INTG → OFF

RT: INTG → ON

4.60 24-DB

RUN # 12

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: SPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION J

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 14:14 OCT 24, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.60 | 230319.00 | 88 | 100.000 |

TOTAL AREA = 230319.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section J-Duplicate

Date Extracted: 10/16/86
Date Analyzed: 10/21/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 77

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 95

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG → OFF

RT: INTG → ON

18.94

22.83

25.70 DBC

OV: STOP RUN

RUN # 15 PESTICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: SPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 AL

SAMPLE ID: SECTION J (DUPL.)

HP 5880A MANUAL INJECTION @ 08:30 OCT 21, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 18.94 | 3995.34 | BP | 1.740 |
| 22.83 | 9592.28 | BV | 4.177 |
| 25.70 | 216052.00 | VB | 94.083 |

TOTAL AREA = 229640.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.60 2,4-D

RUN # 15

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION J (DUPL.)

VOL. INJ.: 3 AL

INP] 5880R MANUAL INJECTION @ 14:44 OCT 24, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.60 | 227532.00 | 98 | 100.000 |

TOTAL AREA = 227532.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section K

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 74

HERBICIDE FRACTION

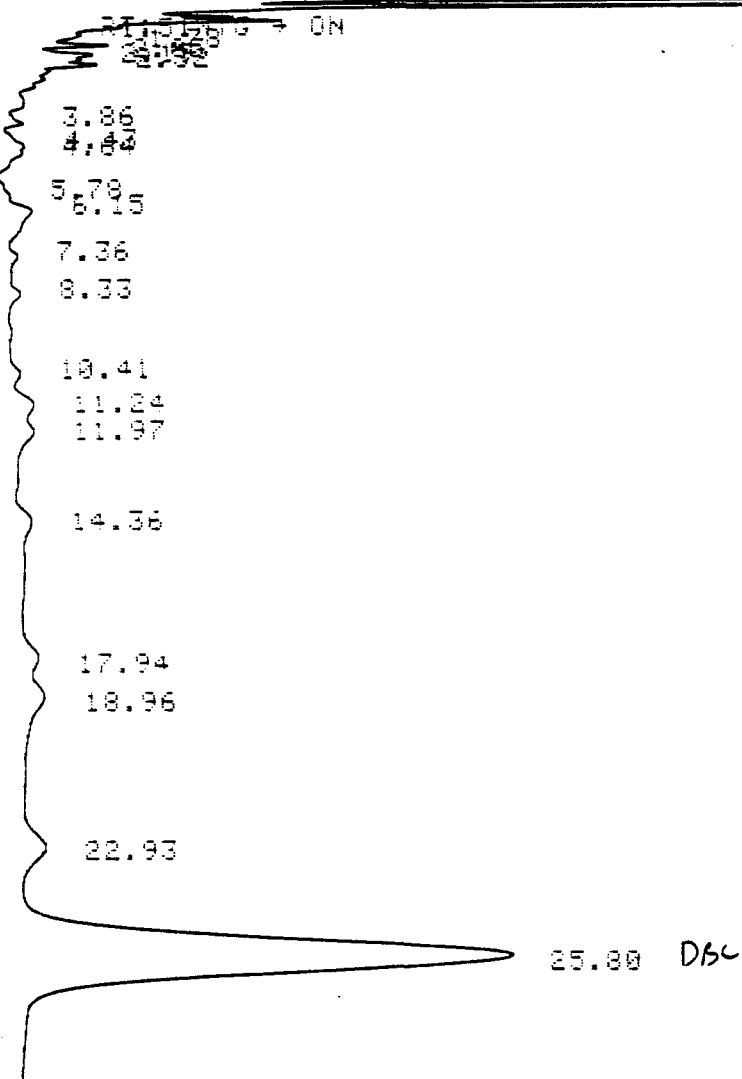
| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 88

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

RT: INTG + OFF



RUN # 9 PESTICIDE ANALYSIS LAB #: 99917
 QUANTITATION RUN CLIENT: BPS
COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401 VOL. INJ.: 3 µL
SAMPLE ID: SECTION K
[hp] 5880A MANUAL INJECTION @ 14:12 OCT 20, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 2.05 | 3330.63 | PV | 1.182 |
| 2.32 | 2771.46 | VV | 0.984 |
| 4.43 | 2758.45 | PV | 0.979 |
| 4.64 | 3203.91 | VP | 1.137 |
| 6.15 | 7296.88 | VB | 2.590 |
| 11.24 | 5357.61 | VV | 1.902 |
| 11.97 | 6685.44 | VV | 2.373 |
| 14.36 | 6503.33 | VP | 2.337 |
| 17.94 | 9572.09 | VV | 3.398 |
| 18.96 | 14775.30 | VV | 5.245 |
| 22.93 | 11437.10 | VV | 4.060 |
| 25.80 | 207911.00 | VB | 73.810 |

TOTAL AREA = 281683.00
MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.86

2,4-DB

RUN # 20

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION K

VOL. INJ.: 3 µL

[HP] 5880A MANUAL INJECTION @ 15:26 OCT 24, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.86 | 211332.00 | 08 | 100.000 |

TOTAL: 9999 - 211332.00

Client: Boeing Petroleum
Sample: Section L

Date Extracted: 10/16/86
Date Analyzed: 10/21/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 72

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 104

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out



ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

22.97

25.83 DBC

OW: STOP RUN

RUN # 24

PESTICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: SPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 µL

SAMPLE ID: SECTION L

【SP】 5880A MANUAL INJECTION @ 13:13 OCT 21, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 22.97 | 9255.38 | BB | 4.357 |
| 25.83 | 203146.00 | BH | 95.643 |

TOTAL AREA = 212401.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.59 2,4-DB

RUN # 8

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION L

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 15:52 OCT 23, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.59 | 167480.00 | BB | 100.000 |

TOTAL AREA = 167480.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section L-Duplicate

Date Extracted: 10/16/86
Date Analyzed: 10/21/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 80

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

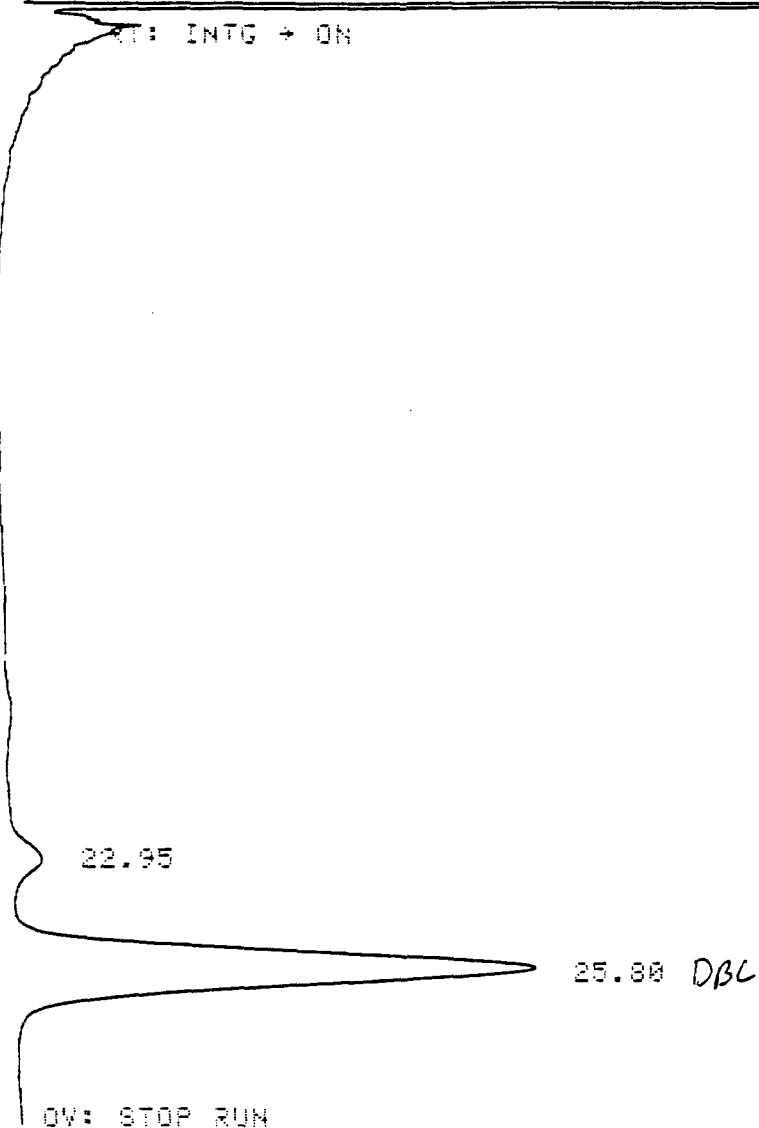
4-(2,4-Dichlorophenoxy)butyric acid Recovery 80

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG → OFF

RT: INTG → ON



RUN # 26

PESTICIDE ANALYSIS
QUANTITATION RUN

LAB #: 99917

CLIENT: BPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 µL

SAMPLE ID: SECTION L (DUPL.)

[HP] 5880A MANUAL INJECTION @ 14:25 OCT 21, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 22.95 | 15793.60 | PH | 6.530 |
| 25.80 | 226076.00 | HH | 93.470 |

TOTAL AREA = 241870.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.61 24-08

RUN # 21

HERBICIDE ANALYSIS
QUANTITATION RUN

LAB #: 99917

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION L (DUPL.)

VOL. INJ.: 3 AL

HP 5890A MANUAL INJECTION @ 15:34 OCT 24, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.61 | 191627.00 | BB | 100.000 |

TOTAL AREA = 191627.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section M

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 96

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

EIRA

ENVIRONMENTAL INDUSTRIAL
RESEARCH ASSOCIATES, INC.

RT: INTG + OFF

RT: 25.76 + ON

3.85

4.42

5.75

6.14

7.35

8.31

11.23

11.93

14.31

17.90

18.92

22.91

25.76 DBL

OV: STOP RUN

RUN # 13 PESTICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: SPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 µL

SAMPLE ID: SECTION M

HP 5880A MANUAL INJECTION @ 16:53 OCT 20, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 1.77 | 2146.04 | PP | 0.825 |
| 2.05 | 3697.43 | PV | 1.421 |
| 2.32 | 2809.66 | VV | 1.080 |
| 4.42 | 2848.80 | PV | 1.095 |
| 4.64 | 3204.17 | VP | 1.232 |
| 6.14 | 7533.55 | VV | 2.896 |
| 11.23 | 4300.34 | VV | 1.653 |
| 11.93 | 4513.37 | VB | 1.735 |
| 14.31 | 4754.81 | PV | 1.829 |
| 17.90 | 4162.36 | BV | 1.600 |
| 18.92 | 7870.55 | VB | 3.026 |
| 22.91 | 7804.64 | PP | 3.000 |
| 25.76 | 204491.00 | PS | 78.609 |

TOTAL AREA = 260136.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.81 24-08

RUN # 22 HERBICIDE ANALYSIS
 QUANTITATION RUN
 COLUMN: 6 FT X 4 MM 3% SP-2250
SAMPLE ID: SECTION M

LAB #: 99917
CLIENT: BPS

VOL. INJ.: 3 µL

IMP 5880A MANUAL INJECTION @ 15:43 OCT 24, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.81 | 229879.00 | SB | 100.000 |

TOTAL AREA = 229879.00
MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section N

Date Extracted: 10/16/86
Date Analyzed: 10/21/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 78

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 80

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

22.96

25.81 DBC

OV: STOP RUN

RUN # 29

PESTICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 µL

SAMPLE ID: SECTION N

INP] 5880A MANUAL INJECTION @ 16:12 OCT 21, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 22.96 | 11703.80 | SV | 5.027 |
| 25.81 | 221127.00 | VB | 94.973 |

TOTAL AREA = 232831.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

2.78

4.56 2,4-DB

RUN # 10 HERBICIDE ANALYSIS
 QUANTITATION RUN
 COLUMN: 6 FT X 4 MM 3% SP-2250
SAMPLE ID: SECTION M

LAB #: 99917
CLIENT: BPS

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 16:08 OCT 23, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|--------|
| 2.78 | 383499.00 | BB | 74.770 |
| 4.56 | 129408.00 | BB | 25.230 |

TOTAL AREA = 512907.00
MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section 0

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 71

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 91

RDL: Required Detection Limit

BDL: Below Detection Limit

** : Below Report Limit, but Detected

B: Detected in Blank

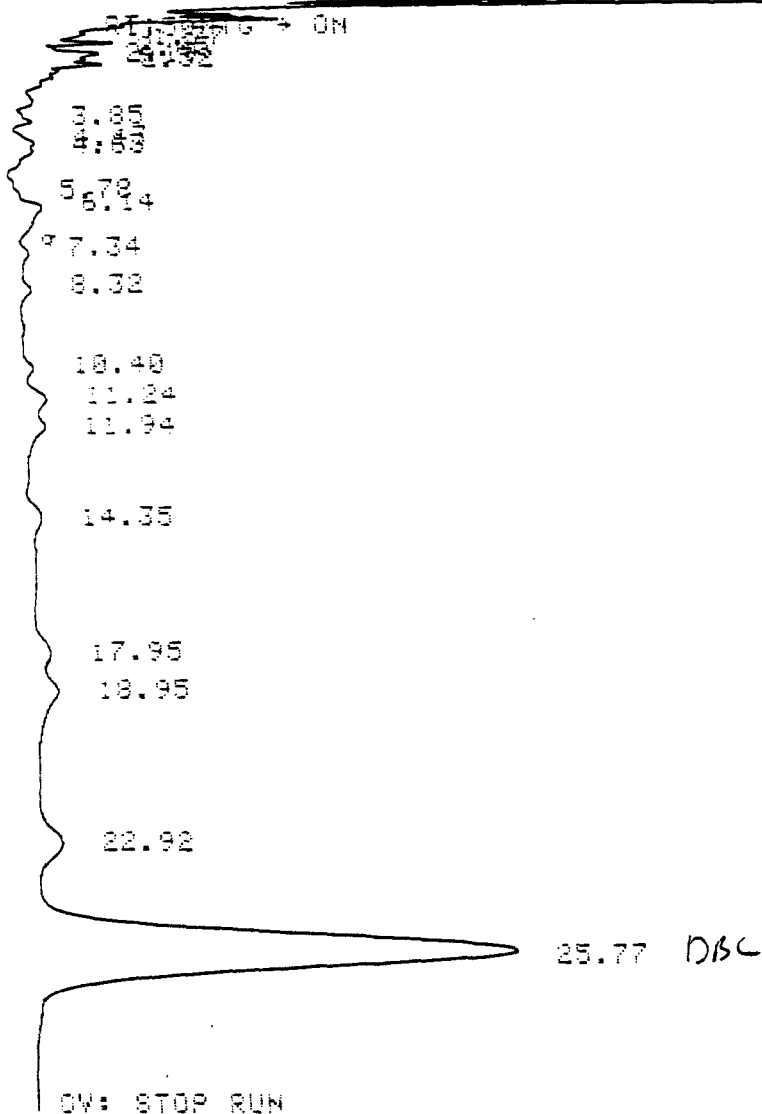
*** DL: Diluted Out

EIRA

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READY FOR INJECTION

RT: INTG → OFF



RUN # 10 PESTICIDE ANALYSIS
QUANTITATION RUN

LAB #: 99917

CLIENT: SPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 µL

SAMPLE ID: SECTION 0

INP: 5880A MANUAL INJECTION @ 14:42 OCT 20, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 2.05 | 3405.93 | PV | 1.369 |
| 2.32 | 2692.34 | VV | 1.082 |
| 4.43 | 2078.51 | PV | 0.835 |
| 6.14 | 5071.50 | BV | 2.038 |
| 11.24 | 4889.80 | VV | 1.965 |
| 11.94 | 4463.18 | VB | 1.793 |
| 14.35 | 4190.90 | BV | 1.684 |
| 17.95 | 4345.98 | BV | 1.746 |
| 18.95 | 8966.63 | VV | 3.603 |
| 22.92 | 8432.02 | BV | 3.388 |
| 25.77 | 200320.00 | VB | 80.496 |

TOTAL AREA = 248857.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTEG + OFF

RT: INTEG + ON

4.64 2,4-DB

RUN # 24

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: CDC

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION 0

VOL. INJ.: 3 AL

INP 5880A MANUAL INJECTION @ 15:59 OCT 24, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.64 | 217861.00 | SB | 100.000 |

TOTAL AREA = 217861.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section P

Date Extracted: 10/16/86
Date Analyzed: 10/21/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchlorendate Recovery 73

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 83

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

RUN TIME = 9.64 MIN

22.96

25.80 DBC

OV: STOP RUN

RUN # 25 PESTICIDE ANALYSIS
QUANTITATION RUN

LAB #: 99917

CLIENT: SPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 µL

SAMPLE ID: SECTION P

INP 5880A MANUAL INJECTION @ 13:44 OCT 21, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 22.96 | 11047.20 | BH | 5.070 |
| 25.80 | 206835.00 | HH | 94.930 |

TOTAL AREA = 217882.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.63 2, 4-DB

RUN # 25

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION P

VOL. INJ.: 3 AL

HP 5880A MANUAL INJECTION @ 16:08 OCT 24, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.63 | 198417.00 | SS | 100.000 |

TOTAL AREA = 198417.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section Q

Date Extracted: 10/16/86
Date Analyzed: 10/21/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchlorendate Recovery 81

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 101

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out



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READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

22.99

25.83 DBC

OV: STOP RUN

RUN # 28 PESTICIDE ANALYSIS
QUANTITATION RUN

LAB #: 99917

CLIENT: BPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 µL

SAMPLE ID: SECTION Q

[HP] 5880A MANUAL INJECTION @ 15:35 OCT 21, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 22.99 | 12996.60 | BH | 5.361 |
| 25.83 | 229426.00 | HH | 94.639 |

TOTAL AREA = 242423.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.83 2.4-DB

RUN # 26 HERBICIDE ANALYSIS LAB #: 99917
 QUANTITATION RUN CLIENT: BPS
 COLUMN: 6 FT X 4 MM 3% SP-2250
SAMPLE ID: SECTION Q VOL. INJ.: 3 AL

【hp】 5880A MANUAL INJECTION @ 16:15 OCT 24, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.83 | 243892.00 | BB | 100.000 |

TOTAL AREA = 243892.00
MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section R

Date Extracted: 10/16/86
Date Analyzed: 10/21/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 84

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

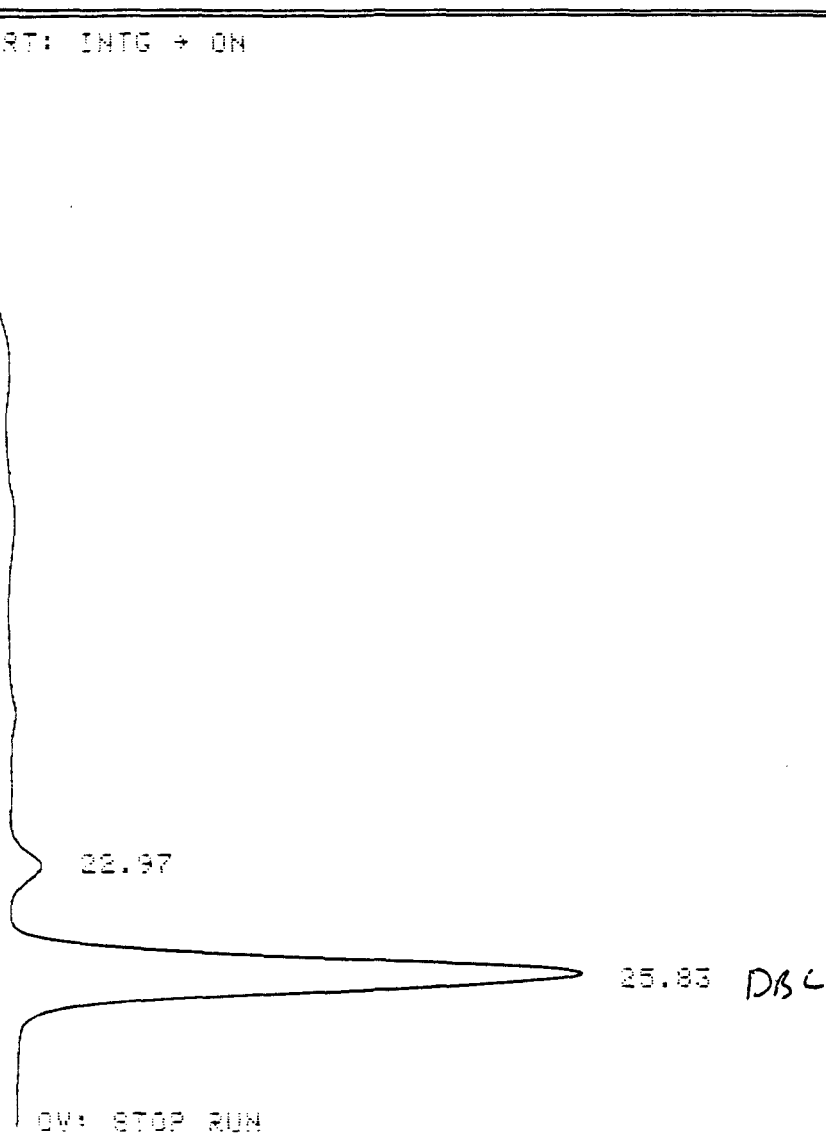
4-(2,4-Dichlorophenoxy)butyric acid Recovery 88

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON



OV: STOP RUN

RUN # 21 PESTICIDE ANALYSIS LAB #: 99917
 QUANTITATION RUN CLIENT: BPS
COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401 VOL. INJ.: 3 µL
SAMPLE ID: SECTION R
[HP] 5880A MANUAL INJECTION @ 11:30 OCT 21, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 22.97 | 10760.30 | SP | 4.355 |
| 25.83 | 236307.00 | PS | 95.645 |

TOTAL AREA = 247067.00
MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.63 24-DB

RUN # 27

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: SPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION R

VOL. INJ.: 3 AL

INP 5880A MANUAL INJECTION @ 16:21 OCT 24, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.63 | 210337.00 | BB | 100.000 |

TOTAL AREA = 210337.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section S

Date Extracted: 10/16/86
Date Analyzed: 10/21/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 82

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 93

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

18.99

22.95

25.80 DBL

OV: STOP RUN

RUN # 22

PESTICIDE ANALYSIS

QUANTITATION RUN

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

SAMPLE ID: SECTION 9

MANUAL INJECTION @ 12:02 OCT 21, 1986

AREA %

LAB #: 99917

CLIENT: BPS

VOL. INJ.: 3 µL

RT

AREA

TYPE

AREA %

22.95

10921.40

BV

4.507

25.80

231407.00

VB

95.493

TOTAL AREA = 242328.00

MULTIPLIER = 1

QT

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.63 2.4-06

RUN # 28

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: SPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: SECTION 8

VOL. INJ.: 3 AL

MANUAL INJECTION @ 16:28 OCT 24, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.63 | 222601.00 | BB | 100.000 |

TOTAL AREA = 222601.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Section T

Date Extracted: 10/16/86
Date Analyzed: 10/21/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 61

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 107

RDL: Required Detection Limit

BDL: Below Detection Limit

** : Below Report Limit, but Detected

B: Detected in Blank

*** DL: Diluted Out

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READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

19.20

23.00

25.83 DBC

OV: STOP RUN

RUN # 23 PESTICIDE ANALYSIS LAB #: 99917
 QUANTITATION RUN CLIENT: BPS
COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401 VOL. INJ.: 3 µL
SAMPLE ID: SECTION T
[HP] 5880A MANUAL INJECTION @ 12:33 OCT 21, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 23.00 | 7730.95 | BB | 4.322 |
| 25.83 | 171155.00 | BB | 95.678 |

TOTAL AREA = 178886.00
MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.59 2,4-DB

RUN # 3 HERBICIDE ANALYSIS
 QUANTITATION RUN
 COLUMN: 6 FT X 4 MM 3% SP-2250
SAMPLE ID: SECTION T

LAB #: 99917
CLIENT: BPS
VOL. INJ.: 3 µL

[AP] 5880A MANUAL INJECTION @ 14:45 OCT 23, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.59 | 172167.00 | BB | 100.000 |

TOTAL AREA = 172167.00
MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Lab Blank #1

Date Extracted: 10/16/86
Date Analyzed: 10/20/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 74

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 97

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out



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READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

19.06

22.99

25.84 DBC

OV: STOP RUN

RUN # 1

PESTICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: SPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 µL

SAMPLE ID: LAB BLANK -/

INP 5880R MANUAL INJECTION @ 09:57 OCT 20, 1986

AREA %

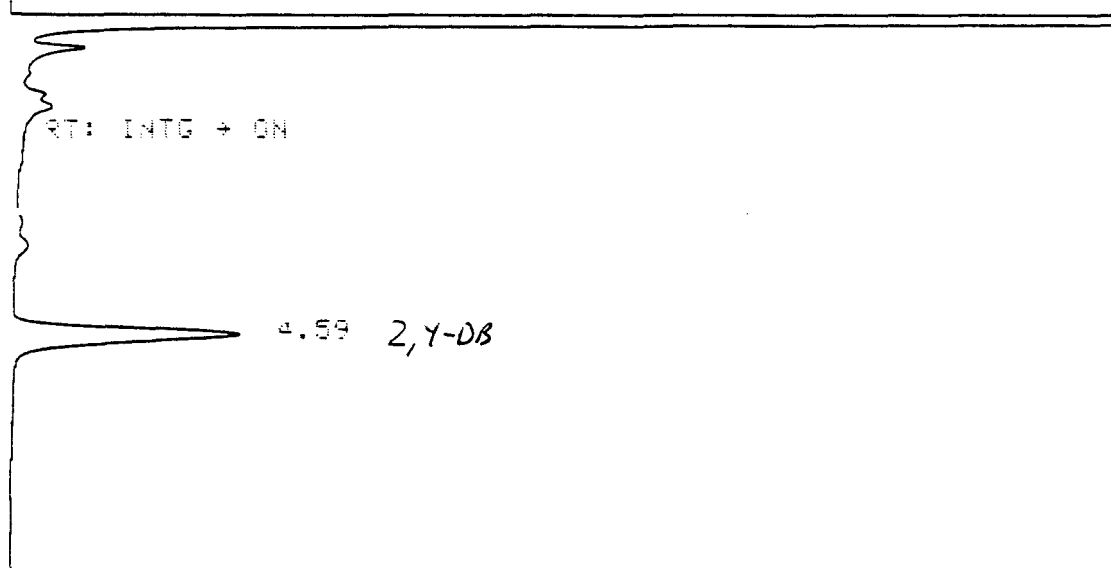
| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 19.06 | 3809.23 | SP | 1.695 |
| 22.99 | 12785.20 | HH | 5.689 |
| 25.84 | 208150.00 | HH | 92.616 |

TOTAL AREA = 224745.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF



RUN # 4

HERBICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: SPS

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: BLANK-1

VOL. INJ.: 3 µL

HP 5880A MANUAL INJECTION @ 14:53 OCT 23, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.59 | 155756.00 | BB | 100.000 |

TOTAL AREA = 155756.00

MULTIPLIER = 1

Client: Boeing Petroleum
Sample: Lab Blank #2

Date Extracted: 10/16/86
Date Analyzed: 10/21/86

PESTICIDE FRACTION

| | <u>Concentration</u> ($\mu\text{g/l}$) | <u>RDL</u> ($\mu\text{g/l}$) |
|--------------|---|-----------------------------------|
| Gamma-BHC | BDL | 0.05 |
| Methoxychlor | BDL | 0.5 |
| Toxaphene | BDL | 1.0 |
| Endrin | BDL | 0.1 |

SURROGATE %

Dibutylchloroendate Recovery 87

HERBICIDE FRACTION

| | | |
|--------|-----|----|
| 2,4-D | BDL | 65 |
| Silvex | BDL | 20 |

SURROGATE %

4-(2,4-Dichlorophenoxy)butyric acid Recovery 93

RDL: Required Detection Limit
BDL: Below Detection Limit
**: Below Report Limit, but Detected
B: Detected in Blank
*** DL: Diluted Out

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

19.14

22.99

25.83 DBC

RUN # 27

PESTICIDE ANALYSIS

LAB #: 99917

QUANTITATION RUN

CLIENT: BPS

COLUMN: 6 FT X 4 MM 1.5% SP-2250/1.95% SP-2401

VOL. INJ.: 3 AL

SAMPLE ID: BLANK-2

INP 38808 MANUAL INJECTION @ 15:05 OCT 21, 1986

AREA %

| RT | AREA | TYPE | AREA % |
|-------|-----------|------|--------|
| 22.99 | 14061.40 | BV | 5.410 |
| 25.83 | 245850.00 | VP | 94.590 |

TOTAL AREA = 259912.00

MULTIPLIER = 1

READY FOR INJECTION

RT: INTG + OFF

RT: INTG + ON

4.65

2,4,-DB

RUN # 18

HERBICIDE ANALYSIS
QUANTITATION RUN

COLUMN: 6 FT X 4 MM 3% SP-2250

SAMPLE ID: BLANK-2

LAB #: 99917
CLIENT: SPS

VOL. INJ.: 3 AL

HP 5820A MANUAL INJECTION @ 15:07 OCT 24, 1986
AREA %

| RT | AREA | TYPE | AREA % |
|------|-----------|------|---------|
| 4.65 | 222307.00 | BB | 100.000 |

TOTAL AREA = 222307.00
MULTIPLIER = 1

ENVIRONMENTAL INDUSTRIAL RESEARCH ASSOCIATES
2445 Florida Avenue
Kenner, Louisiana 70062
(504) 469-0333

METHODS

Inorganic Analyses on Water and Wastewater:

Standard Methods for the Evaluation of Water and Wastewater, APHA, AWWA, WPCF:
16th Edition, 1985.


Soils, Sediments and Hazardous Waste Evaluation Procedures:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846,
U.S.E.P.A. Second Edition Revised April, 1984.

Organic Analyses on Water and Wastewater:

"Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater", 40
CFR Part 136, Appendix A., U.S.E.P.A, Amended June 30, 1986.


Other methods if used are referenced with analytical results.



John R. Troost,
Manager of Analytical Services

Date

10/30/86



Thomas E. Orr,
Quality Assurance Coordinator

Date

10/30/86

APPENDIX E
HAZARD RANKING SYSTEM WORKSHEETS

BAYOU CHOCTAW CAVERN 10
HAZARD RANKING SYSTEM WORKSHEETS

Facility name: Bayou Choctaw SPP Site

Location: Plaquemine, LA

EPA Region: VI

Person(s) in charge of the facility: J. Hyde

Name of Reviewer: C. Upton

Date: 4/27/87

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Inactive solution mined cavern (cavern 10)

Scores: $S_M = 5.85$ ($S_{gw} = 9.07$ $S_{sw} = 4.48$ $S_A = 0.00$)

$S_{FE} = N/A$

$S_{DC} = 0$

| Ground Water Route Work Sheet | | | | | | | |
|---|--|-------------|-----------------|------------|----------------|--|--|
| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) | | |
| 1 Observed Release | (1) (0) 45 | 1 | 0 | 45 | 3.1 | | |
| If observed release is given a score of 45, proceed to line 4 . If observed release is given a score of 0, proceed to line 2 . | | | | | | | |
| 2 Route Characteristics | | | | | 3.2 | | |
| Depth to Aquifer of Concern | (2) 0 1 (2) 3 | 2 | 4 | 6 | | | |
| Net Precipitation | (3) 0 1 (2) 3 | 1 | 2 | 3 | | | |
| Permeability of the Unsaturated Zone | (4) 0 (1) 2 3 | 1 | 1 | 3 | | | |
| Physical State | (5) 0 1 2 (3) | 1 | 3 | 3 | | | |
| Total Route Characteristics Score | | | 10 | 15 | | | |
| 3 Containment | (6) 0 (1) 2 3 | 1 | 1 | 3 | 3.3 | | |
| 4 Waste Characteristics | | | | | 3.4 | | |
| Toxicity/Persistence | (7) 0 3 6 9 12 15 18 | 1 | 18 | 18 | | | |
| Hazardous Waste Quantity | (8) 0 1 (2) 3 4 5 6 7 8 | 1 | 2 | 8 | | | |
| Total Waste Characteristics Score | | | 20 | 26 | | | |
| 5 Targets | | | | | 3.5 | | |
| Ground Water Use | (9) 0 1 (2) 3 | 3 | 6 | 9 | | | |
| Distance to Nearest Well/Population Served | (10) 0 4 6 8 10 12 16 18 (20) 24 30 32 35 40 | 1 | 20 | 40 | | | |
| Total Targets Score | | | 26 | 49 | | | |
| 6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 5200 | 57,330 | | | |
| 7 Divide line 6 by 57,330 and multiply by 100 | | | $S_{gw} = 9.07$ | | | | |

| Surface Water Route Work Sheet | | | | | | |
|---|---|-------------|------------------------|------------|----------------|--|
| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) | |
| 1 Observed Release (1) | (0) 45 | 1 | 0 | 45 | 4.1 | |
| If observed release is given a value of 45, proceed to line 4 . If observed release is given a value of 0, proceed to line 2 . | | | | | | |
| 2 Route Characteristics | | | | | 4.2 | |
| Facility Slope and Intervening Terrain (2) | (0) 1 2 3 | 1 | 0 | 3 | | |
| 1-yr. 24-hr. Rainfall (3) | 0 1 2 (3) | 1 | 3 | 3 | | |
| Distance to Nearest Surface Water (4) | 0 1 2 (3) | 2 | 6 | 6 | | |
| Physical State (5) | 0 1 2 (3) | 1 | 3 | 3 | | |
| Total Route Characteristics Score | | | 12 | 15 | | |
| 3 Containment (6) | 0 (1) 2 3 | 1 | 1 | 3 | 4.3 | |
| 4 Waste Characteristics | | | | | 4.4 | |
| Toxicity/Persistence (7) | 0 3 6 9 12 15 (18) | 1 | 18 | 18 | | |
| Hazardous Waste Quantity (8) | 0 1 (2) 3 4 5 6 7 8 | 1 | 2 | 8 | | |
| Total Waste Characteristics Score | | | 20 | 26 | | |
| 5 Targets | | | | | 4.5 | |
| Surface Water Use (9) | 0 1 (2) 3 | 3 | 6 | 9 | | |
| Distance to a Sensitive Environment (10) | 0 1 2 (3) | 2 | 6 | 6 | | |
| Population Served/Distance to Water Intake Downstream (11) | (0) 4 6 8 10 12 16 18 20 24 30 32 35 40 | 1 | 0 | 40 | | |
| Total Targets Score | | | 12 | 55 | | |
| 6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 2880 | 64,350 | | |
| 7 Divide line 6 by 64,350 and multiply by 100 | | | S _{sw} = 4.48 | | | |

| Air Route Work Sheet | | | | | | | |
|--|--------------------------------|-------------|-------|------------|----------------|--|--|
| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) | | |
| 1 Observed Release | (1) (0) 45 | 1 | | 45 | 5.1 | | |
| Date and Location: | | | | | | | |
| Sampling Protocol: | | | | | | | |
| If line 1 is 0, the $S_a = 0$. Enter on line 5 . If line 1 is 45, then proceed to line 2 . | | | | | | | |
| 2 Waste Characteristics | | | | | 5.2 | | |
| Reactivity and Incompatibility | 0 1 2 3 | 1 | | 3 | | | |
| Toxicity | 0 1 2 3 | 3 | | 9 | | | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | | 8 | | | |
| Total Waste Characteristics Score | | | | 20 | | | |
| 3 Targets | | | | | 5.3 | | |
| Population Within 4-Mile Radius | 0 9 12 15 18 21 24 27 30 | 1 | | 30 | | | |
| Distance to Sensitive Environment | 0 1 2 3 | 2 | | 6 | | | |
| Land Use | 0 1 2 3 | 1 | | 3 | | | |
| Total Targets Score | | | | 39 | | | |
| 4 Multiply 1 x 2 x 3 | | | | 35,100 | | | |
| 5 Divide line 4 by 35,100 and multiply by 100 $S_a = 0$ | | | | | | | |

| | S | S ² |
|---|------|----------------|
| Groundwater Route Score (S _{gw}) | 9.07 | 82.3 |
| Surface Water Route Score (S _{sw}) | 4.48 | 20.1 |
| Air Route Score (S _a) | 0.00 | 00.0 |
| $S_{gw}^2 + S_{sw}^2 + S_a^2$ | | 102.4 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$ | | 10.1 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$ | | 5.85 |

| Fire and Explosion Work Sheet (1) | | | | | | | | | |
|--|--------------------------------|---|---|---|---|-----------------|-----------|---------------|-------------------|
| Rating Factor | Assigned Value (Circle One) | | | | | Multi- plier | Score | Max. Score | Ref. (Section) |
| 1 Containment | 1 | 3 | | | | 1 | | 3 | 7.1 |
| 2 Waste Characteristics | | | | | | | | | 7.2 |
| Direct Evidence | 0 | 3 | | | | 1 | | 3 | |
| Ignitability | 0 | 1 | 2 | 3 | | 1 | | 3 | |
| Reactivity | 0 | 1 | 2 | 3 | | 1 | | 3 | |
| Incompatibility | 0 | 1 | 2 | 3 | | 1 | | 3 | |
| Hazardous Waste Quantity | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Total Waste Characteristics Score | | | | | | | | 20 | |
| 3 Targets | | | | | | | | | 7.3 |
| Distance to Nearest Population | 0 | 1 | 2 | 3 | 4 | 5 | 1 | 5 | |
| Distance to Nearest Building | 0 | 1 | 2 | 3 | | | 1 | 3 | |
| Distance to Sensitive Environment | 0 | 1 | 2 | 3 | | | 1 | 3 | |
| Land Use | 0 | 1 | 2 | 3 | | | 1 | 3 | |
| Population Within 2-Mile Radius | 0 | 1 | 2 | 3 | 4 | 5 | 1 | 5 | |
| Buildings Within 2-Mile Radius | 0 | 1 | 2 | 3 | 4 | 5 | 1 | 5 | |
| Total Targets Score | | | | | | | | 24 | |
| 4 Multiply 1 x 2 x 3 | | | | | | | | 1,440 | |
| 5 Divide line 4 by 1,440 and multiply by 100 | | | | | | | SFE = N/A | | |

| Direct Contact Work Sheet | | | | | | |
|---|--------------------------------|-----------------|---------|---------------|-------------------|--|
| Rating Factor | Assigned Value (Circle One) | Multi- plier | Score | Max. Score | Ref. (Section) | |
| 1 Observed Incident (1) (0) 45 | | 1 | 0 | 45 | 8.1 | |
| If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2 | | | | | | |
| 2 Accessibility (2) (0) 1 2 3 | | 1 | 0 | 3 | 8.2 | |
| 3 Containment (3) 0 (15) | | 1 | 15 | 15 | 8.3 | |
| 4 Waste Characteristics Toxicity (4) 0 1 2 3 | | 5 | 15 | 15 | 8.4 | |
| 5 Targets | | | | | 8.5 | |
| Population Within a (5) (0) 1 2 3 4 5 | | 4 | 0 | 20 | | |
| 1-Mile Radius | | | | | | |
| Distance to a (6) 0 1 2 (3) | | 4 | 12 | 12 | | |
| Critical Habitat | | | | | | |
| Total Targets Score | | | 12 | 32 | | |
| 6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 0 | 21,600 | | |
| 7 Divide line 6 by 21,600 and multiply by 100 | | | SDC = 0 | | | |

Basis for Bayou Choctaw Cavern 10 Hazard Ranking System Ratings

Groundwater

1. No observed release
2. Sixty feet from surface to Shallow Plaquemine Aquifer. Assumes release through wellhead
3. Approximately 56 inches of rain and 48 inches evaporation per year
4. Silty clay
5. Liquid
6. Thought to be contained in well. No leachate collection system
7. Highly persistent, Sax Toxicity 3
8. 531 ft³ of caustic 20 yd³
9. Some residential use, but conversion to Plaquemine city water is possible
10. Well on-site, used by site personnel

Surface Water

1. No observed release
2. Site is flat
3. 4.5 inches
4. < 100 feet to East West Canal
5. Liquid
6. Thought to be contained in well. No dike or diversion system
7. Highly persistent, Sax Toxicity 3
8. 531 ft³ of caustic = 20 yd³
9. Some recreational use
10. Less than 100 feet to wetland
11. Population does not use surface water

Air

1. No observed release

Fire and Explosion

1. Site has not been demonstrated to be an explosion hazard

Direct Contact

1. No observed incident
2. Site has 24 hour surveillance. Cavern is only accessible to authorized personnel
3. Accessible by wellhead valves
4. Sax Toxicity 3
5. Only authorized personnel allowed
6. Less than $\frac{1}{4}$ mile to wetland

BIG HILL WELLS
HAZARD RANKING SYSTEM WORKSHEETS

Facility name: Big Hill SPR Site

Location: Jefferson County, Texas

EPA Region: VI

Person(s) in charge of the facility: A. Fruge

Name of Reviewer: C. Upton

Date: 4/27/87

General description of the facility:

(For example: landfill, surface impoundment, pile, container; types of hazardous substances; location of the facility; contamination route of major concern; types of information needed for rating; agency action, etc.)

Twenty-eight wells, drilled into the salt dome, with brine containing
hazardous substances.

Scores: $S_M = 4.41$ ($S_{gw} = 5.10$ $S_{sw} = 5.67$ $S_s = 0$)

$S_{FE} = \text{N/A}$

$S_{DC} = 0$

| Ground Water Route Work Sheet | | | | | | |
|---|---|-----------------|-----------------|---------------|-------------------|--|
| Rating Factor | Assigned Value (Circle One) | Multi- plier | Score | Max. Score | Ref. (Section) | |
| 1 Observed Release (1) | 0 45 | 1 | 0 | 45 | 3.1 | |
| If observed release is given a score of 45, proceed to line 4 . If observed release is given a score of 0, proceed to line 2 . | | | | | | |
| 2 Route Characteristics | | | | | 3.2 | |
| Depth to Aquifer of Concern (2) | 0 1 2 (3) | 2 | 6 | 6 | | |
| Net Precipitation (3) | 0 (1) 2 3 | 1 | 1 | 3 | | |
| Permeability of the Unsaturated Zone (4) | 0 (1) 2 3 | 1 | 1 | 3 | | |
| Physical State (5) | 0 1 2 (3) | 1 | 3 | 3 | | |
| Total Route Characteristics Score | | | 11 | 15 | | |
| 3 Containment (6) | 0 (1) 2 3 | 1 | 1 | 3 | 3.3 | |
| 4 Waste Characteristics | | | | | 3.4 | |
| Toxicity/Persistence (7) | 0 3 6 9 12 15 (18) | 1 | 18 | 18 | | |
| Hazardous Waste Quantity (8) | 0 (1) 2 3 4 5 6 7 8 | 1 | 1 | 8 | | |
| Total Waste Characteristics Score | | | 19 | 26 | | |
| 5 Targets | | | | | 3.5 | |
| Ground Water Use (9) | 0 1 (2) 3 | 3 | 6 | 9 | | |
| Distance to Nearest Well/Population Served (10) | 0 4 8 (8) 10 12 16 18 20 24 30 32 35 40 | 1 | 8 | 40 | | |
| Total Targets Score | | | 14 | 49 | | |
| 6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 2926 | 57,330 | | |
| 7 Divide line 6 by 57,330 and multiply by 100 | | | $S_{gw} = 5.10$ | | | |

| Surface Water Route Work Sheet | | | | | | |
|---|---|-------------|------------------------|------------|----------------|--|
| Rating Factor | Assigned Value (Circle One) | Multi-plier | Score | Max. Score | Ref. (Section) | |
| 1 Observed Release (1) | 0 45 | 1 | 0 | 45 | 4.1 | |
| If observed release is given a value of 45, proceed to line 4 . If observed release is given a value of 0, proceed to line 2 . | | | | | | |
| 2 Route Characteristics | | | | | 4.2 | |
| Facility Slope and Intervening Terrain (2) | (0) 1 2 3 | 1 | 0 | 3 | | |
| 1-yr. 24-hr. Rainfall (3) | 0 1 2 (3) | 1 | 3 | 3 | | |
| Distance to Nearest Surface Water (4) | 0 1 2 (3) | 2 | 6 | 6 | | |
| Physical State (5) | 0 1 2 (3) | 1 | 3 | 3 | | |
| Total Route Characteristics Score | | | 12 | 15 | | |
| 3 Containment (6) | 0 (1) 2 3 | 1 | 1 | 3 | 4.3 | |
| 4 Waste Characteristics | | | | | 4.4 | |
| Toxicity/Persistence (7) | 0 3 6 9 12 15 (18) | 1 | 18 | 18 | | |
| Hazardous Waste Quantity (8) | 0 (1) 2 3 4 5 6 7 8 | 1 | 1 | 8 | | |
| Total Waste Characteristics Score | | | 19 | 26 | | |
| 5 Targets | | | | | 4.5 | |
| Surface Water Use (9) | 0 1 (2) 3 | 3 | 6 | 9 | | |
| Distance to a Sensitive Environment (10) | 0 (1) 2 3 | 2 | 2 | 6 | | |
| Population Served/Distance to Water Intake Downstream (11) | 0 4 6 (8) 10 12 16 18 20 24 30 32 35 40 | 1 | 8 | 40 | | |
| Total Targets Score | | | 16 | 55 | | |
| 6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 3648 | 64,350 | | |
| 7 Divide line 6 by 64,350 and multiply by 100 | | | S _{sw} = 5.67 | | | |

| Air Route Work Sheet | | | | | | |
|--|--------------------------------|-----------------|-----------|---------------|-------------------|--|
| Rating Factor | Assigned Value (Circle One) | Multi- plier | Score | Max. Score | Ref. (Section) | |
| 1 Observed Release (1) | (0) 45 | 1 | 0 | 45 | 5.1 | |
| Date and Location: | | | | | | |
| Sampling Protocol: | | | | | | |
| If line 1 is 0, the $S_a = 0$. Enter on line 5 . If line 1 is 45, then proceed to line 2 . | | | | | | |
| 2 Waste Characteristics | | | | | 5.2 | |
| Reactivity and Incompatibility | 0 1 2 3 | 1 | | 3 | | |
| Toxicity | 0 1 2 3 | 3 | | 9 | | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | | 8 | | |
| Total Waste Characteristics Score | | | | 20 | | |
| 3 Targets | | | | | 5.3 | |
| Population Within 4-Mile Radius | 0 9 12 15 18 21 24 27 30 | 1 | | 30 | | |
| Distance to Sensitive Environment | 0 1 2 3 | 2 | | 6 | | |
| Land Use | 0 1 2 3 | 1 | | 3 | | |
| Total Targets Score | | | | 39 | | |
| 4 Multiply 1 x 2 x 3 | | | | 35,100 | | |
| 5 Divide line 4 by 35,100 and multiply by 100 | | | $S_a = 0$ | | | |

| | S | S ² |
|---|------|----------------|
| Groundwater Route Score (S _{gw}) | 5.10 | 26.0 |
| Surface Water Route Score (S _{sw}) | 5.67 | 32.1 |
| Air Route Score (S _a) | 0.00 | 0.00 |
| $S_{gw}^2 + S_{sw}^2 + S_a^2$ | | 58.1 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2}$ | | 7.62 |
| $\sqrt{S_{gw}^2 + S_{sw}^2 + S_a^2} / 1.73 = S_M =$ | | 4.41 |

| Fire and Explosion Work Sheet (1) | | | | | | |
|--|--------------------------------|-----------------|-----------|---------------|-------------------|--|
| Rating Factor | Assigned Value (Circle One) | Multi- plier | Score | Max. Score | Ref. (Section) | |
| 1 Containment | 1 3 | 1 | | 3 | 7.1 | |
| 2 Waste Characteristics | | | | | 7.2 | |
| Direct Evidence | 0 3 | 1 | | 3 | | |
| Ignitability | 0 1 2 3 | 1 | | 3 | | |
| Reactivity | 0 1 2 3 | 1 | | 3 | | |
| Incompatibility | 0 1 2 3 | 1 | | 3 | | |
| Hazardous Waste Quantity | 0 1 2 3 4 5 6 7 8 | 1 | | 8 | | |
| Total Waste Characteristics Score | | | | 20 | | |
| 3 Targets | | | | | 7.3 | |
| Distance to Nearest Population | 0 1 2 3 4 5 | 1 | | 5 | | |
| Distance to Nearest Building | 0 1 2 3 | 1 | | 3 | | |
| Distance to Sensitive Environment | 0 1 2 3 | 1 | | 3 | | |
| Land Use | 0 1 2 3 | 1 | | 3 | | |
| Population Within 2-Mile Radius | 0 1 2 3 4 5 | 1 | | 5 | | |
| Buildings Within 2-Mile Radius | 0 1 2 3 4 5 | 1 | | 5 | | |
| Total Targets Score | | | | 24 | | |
| 4 Multiply 1 x 2 x 3 | | | | 1,440 | | |
| 5 Divide line 4 by 1,440 and multiply by 100 | | | SFE = N/A | | | |

| Direct Contact Work Sheet | | | | | | |
|---|--------------------------------|-----------------|---------|---------------|-------------------|--|
| Rating Factor | Assigned Value (Circle One) | Multi- plier | Score | Max. Score | Ref. (Section) | |
| 1 Observed Incident (1) | (0) 45 | 1 | 0 | 45 | 8.1 | |
| If line 1 is 45, proceed to line 4 If line 1 is 0, proceed to line 2 | | | | | | |
| 2 Accessibility (2) | (0) 1 2 3 | 1 | 0 | 3 | 8.2 | |
| 3 Containment (3) | 0 (15) | 1 | 15 | 15 | 8.3 | |
| 4 Waste Characteristics Toxicity (4) | 0 1 2 (3) | 5 | 15 | 15 | 8.4 | |
| 5 Targets | | | | | 8.5 | |
| Population Within a (5) | (0) 1 2 3 4 5 | 4 | 0 | 20 | | |
| 1-Mile Radius | | | | | | |
| Distance to a (6) | 0 (1) 2 3 | 4 | 4 | 12 | | |
| Critical Habitat | | | | | | |
| Total Targets Score | | | 4 | 32 | | |
| 6 If line 1 is 45, multiply 1 x 4 x 5 If line 1 is 0, multiply 2 x 3 x 4 x 5 | | | 0 | 21,600 | | |
| 7 Divide line 6 by 21,600 and multiply by 100 | | | SDC = 0 | | | |

Basis for Big Hill Hazard Ranking System Ratings

Groundwater

1. No observed release
2. Depth to groundwater of 6-10 feet (Prairie sand layer of Chicot Aquifer)
3. 44 inches mean annual precipitation, 52 inches mean annual evaporation
4. Clay and silty loam
5. Liquid
6. Contained in salt formation, but no leachate collection system
7. Sax Toxicity 3, highly persistent
8. Only dilute substances in brine are present
9. Probably some drinking water use from a private well
10. Less than one mile to well, serves less than 100 people

Surface Water

1. No observed release
2. Slopes of < 3%
3. One year 24 hour rainfall of four inches
4. Distance to pond < 1,000 feet
5. Liquid
6. Wellpad dikes system under construction. Only means of escape would be through wellhead failure or severance.
7. Sax Toxicity 3, highly persistent
8. Only dilute substances in brine are present
9. Some irrigation use as well as industrial
10. Approximately one mile to wetlands
11. Less than one mile to intake, less than 100 people served

Air

1. No observed release

Fire and explosion

1. Not demonstrated to be a fire or explosion hazard

Direct contact

1. No observed incident
2. Site has 24 hour surveillance and is only accessible to authorized personnel
3. Accessible via wellhead
4. Sax Toxicity 3
5. Only authorized personnel allowed
6. Approximately one mile to wetlands